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Piloting an Intervention to Provide Tailored Feedback on Health Behaviors to Adolescents in Pediatric Primary Care

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PILOTING AN INTERVENTION TO PROVIDE TAILORED FEEDBACK ON HEALTH BEHAVIORS TO ADOLESCENTS IN PEDIATRIC PRIMARY CARE

BY

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Abstract

Background:

The pediatrician's office frequently provides the first opportunity for behavioral health intervention. However, pediatricians are limited in time, tools, and training to assess and treat behavioral health problems. Even a brief intervention Motivational Interviewing intervention more than doubles the length of a physical exam appointment. Studies investigating the usefulness of technology to assist with behavioral health interventions in pediatric primary care are limited, but one study found that technology was a feasible approach for use in pediatric primary care (Harris et. al., 2012). That study assessed for alcohol with computer technology and provided the findings to the attending physicians who then delivered the MI intervention (Harris et. al., 2012). A next step approach would be to include a computerized intervention. One such computer intervention is by delivering electronic feedback messages targeting a specific behavior, such as smoking. Additionally, tailored feedback interventions based on unique characteristics of an individual have been demonstrated to be more successful than generic informational feedback (Kreuter, 1999; Noar, 2007). Another innovative approach to creating feedback is may be to take a harm reduction approach with adolescents to encourage an increase in healthy behaviors rather than solely focus on discouraging risk behaviors (Mauriello, 2010; Velicer, 2013). Furthermore, tailored feedback messages are more successful when supported by an underlying theory of behavior change. For example, The Transtheoretical Model (TTM), which is based on the decision making of an individual for intentional change, identifies change as a process involving progress through a series of stages primarily seen as related to Decisional Balance and Self-efficacy. In sum, the best evidence tells us that a theory-based tailored

feedback intervention using computer technology evokes successful behavior change in a manner that is feasible for in primary care (Noar, 2007). To date, no one study has completely integrated behavioral assessment with a feedback intervention based on the TTM in a pediatric primary care setting. The primary aim of this project was to use a step-by-step approach to Program Evaluation to develop, pilot, and test the feasibility of a computerized assessment of behaviors followed by brief stage-tailored feedback promoting health behaviors to patients and physicians in a pediatric primary care setting.

Methods:

Key informant interviews were conducted to engage key stakeholders. Pediatricians and staff were asked to discuss their normal standard of care to understand how best to integrate the program into the office practice, and to gather input into the development of the computerized assessment and feedback system.

A literature review of validated measures was conducted to construct an assessment measure and tailored feedback. The behavioral constructs that were found to be most prevalent in the literature and of concern to pediatricians were included (alcohol, marijuana, nicotine use, caffeine intake, sleep habits, disordered eating behavior, exercise, and stress management). Tailored feedback was based on two specific targeted unhealthy behaviors (alcohol use and marijuana use) as well as two specific healthy behaviors (stress management and exercise) to increase healthy activities for all participants. Microsoft Access software was chosen based on the requirements of the Information Technology team for the pediatric office. A computer programmer was hired to load the program titles Multiple Assessment Symptom Checklist Of Teens (MASCOT) onto the tablet. This project IRB approved.

Results:

Patients between the ages of 13 and 21 years visiting Narragansett Bay Pediatrics for a well-visit were recruited to participate in this study. One pediatrician in a large pediatric office and her patients (N=55 total) participated in this study. Patients between the ages of 13 and 21 years visiting Narragansett Bay Pediatrics for a well-visit were recruited to participate in this study. Participants completed a cognitive assessment (n=10) to test the system for time duration of administration, to ensure that instruction sets and content of feedback were understood, evaluated concerns with user interface, and programming errors, typos, and other minor edits were made to the system. A second sample (n=8) was assessed in the same manner and minor adjustments were made. The remaining participants (n=37) used the revised system. Patients denied any difficulty using the system. They reported that the feedback was helpful and the system prompted them to talk to the doctor about something they might not have otherwise. Patients reported high alcohol use (57%) and marijuana use (46%). Physicians reported that they intervened on all behaviors except stress management. Two of the interventions included the patient's parents. There were no statistically significant differences in behavior change, but it did appear that some patients moved from precontemplation to contemplation and preparation for the reduction of alcohol use.

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First and foremost, I thank my advisor and mentor, Dr. Mark Robbins, Ph.D. who has been my biggest supporter and advocate. Without his guidance, this project would not have been possible. Thank you for believing in me. Thank you also to Dr. Kiessling, M.D., who for many years worked to increase access and improve mental health services for children in Rhode Island, and who was instrumental in putting together the key stakeholder for this project. Thank you to Dr. Corcoran, M.D. for opening up her practice to support increased mental health screening for youth in Rhode Island and for believing that integrated medicine is important and worthy of development. Thank you to Dr. Corcoran's office manager, Andi Srabian, for assisting in the implementation of the project and for managing my frantic calls and emails. Thank you to Dr. Andrea Paiva, Ph.D. for working with me despite being in high demand among graduate students for her approachable style and methodological expertise. Thank you to Dr. Sue Adams, Ph.D., for being on my committee, for her support and encouragement as well as her input as a Child Development expert. Thank you to Susan Brand, Ph.D., friend and colleague, for agreeing to be my committee chair. I would like to acknowledge Michelle Loxley for working with me on this project from start to finish. Without her programming abilities and knowledge of research data collection, this project could not have been successful. Thank you to the Graduate School for the URI Enhancement of Graduate Research Awards Grant for funding this project. Last, but certainly not least, I would like to thank my family, especially all of the strong women who have influenced me along the way; my grandmother, Wanda, my mother, Julie, my aunt, Donna, my sisters, Colleen and Carrie and my cousin, Melissa.

Dedication

I dedicate this dissertation to my daughter, Abigail Marie Adolfo, who for all of her ten years has lived with a graduate student mom. I hope I have instilled in you a love of learning and a desire to learn what you love.

Preface

The dissertation herein can best be described using a program evaluation framework. Program development and evaluation are presented in chronological order from initiation through completion with a summary of findings and lessons learned, and is presented in manuscript format.

According to the Centers for Disease Control (CDC), the term ‘program" describes any organized public health action; including direct service interventions, research initiatives and infrastructure building (CDC.gov, 2012). The term “evaluation” is defined as the systematic investigation of the merit, worth or significance of a program (Scriven, 1999). Also according to the CDC, the CDC’s evaluation framework provides a systematic way to approach and answer these questions using a series of steps each with its own set of standards. Using the following steps as a framework, all of the necessary questions above are addressed. The steps as they are presented by the CDC:

“1. **Engage stakeholders**, including those involved in program operations; those served or affected by the program; and primary users of the evaluation.

2. **Describe the program**, including the need, expected effects, activities, resources, stage, context and logic model.

3. **Focus the evaluation design** to assess the issues of greatest concern to stakeholders while using time and resources as efficiently as possible. Consider the purpose, users, uses, questions, methods and agreements.

4. **Gather credible evidence** to strengthen evaluation judgments and the recommendations that follow. These aspects of evidence gathering typically affect perceptions of credibility: indicators, sources, quality, quantity and logistics.

5. **Justify conclusions** by linking them to the evidence gathered and judging them against agreed-upon values or standards set by the stakeholders. Justify conclusions on the basis of evidence using these five elements: standards, analysis/synthesis, interpretation, judgment and recommendations.

6. **Ensure use and share lessons learned** with these steps: design, preparation, feedback, follow-up and dissemination."

In the following document, a statement of the problem is presented to illustrate why this program evaluation is necessary. The remaining chapters are outlined according to the steps for program evaluation, which describes chronologically the process of program development and evaluation. Finally, the appendix includes copies of the documents referenced within the chapters.

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A. Statement and Review of the Problem

The pediatrician's office provides a unique opportunity for early intervention of behavioral health problems. The American Academy of Pediatrics currently recommends that pediatricians screen for behavioral health risks; however, pediatricians are limited in time, opportunity and sometimes training to assess and intervene on the most common health behaviors. A review of current practice finds that assessment and treatment continues to vary greatly by individual practice (Kreiner et. al, 2006; Wissow et. al., 2013). With physicians being asked to do increasingly more to assess and treat behavioral issues in the limited time allotted for a well visit, researchers are seeking innovative methods to aid them in addressing the need to improve assessment and support for behavioral issues (Kreiner et. al, 2006).

One way to assist physicians in assessing and treating behavioral health during a well visit is to utilize computer assisted programs. To date, computer assisted assessment and intervention programs for use in pediatrics have been limited (Newman, 2011). One parent-reported web-based behavioral health pre-screen of younger children (aged 4-10 years) was found to have utility for identifying problem behaviors in primary care (Fothergill et al., 2013). Three studies were found investigating computer-assisted behavioral assessments among adolescents (Husky et al., 2010; Harris et. al, 2012; Gadomski at al., 2015). Two studies supported pre-screening for behavioral health problems prior to a well care visit indicating that a computerized self-assessment with adolescents in a primary care was feasible, allowed more time for physicians to address priority concerns, and increased the likelihood of having conversations of those priorities between patient and physician (Gadomski at al., 2015; Husky et. al., 2010). Another

study using computer assisted assessments for alcohol use specifically among adolescents was reported to be efficacious. In that study, the computer provided feedback about the assessment to the physicians and the physicians were then responsible for counseling the teens using motivational interviewing (MI) techniques (Harris et. al., 2012). While the physician delivered MI was effective, the intervention more than double the time allotted for a well care visit (Kreiner et. al, 2006). The authors concluded that computerized assessments at the time of an appointment with the pediatrician are feasible in primary care, but suggested that a computerized follow-up intervention might be preferable to physician delivered MI in a primary care setting (Harris et. al., 2012).

A potential computer-driven technique that replaces the physician delivery of MI is the use of an electronic feedback message. Feedback is based on a completed assessment and may take many forms. Feedback ranges from generic information targeting a specific behavior, such as smoking, to highly tailored feedback based on the unique characteristics of an individual (Kreuter, 1999). A tailored message, on smoking for example, might be include the amount a person reported smoking as compare with others their age, or it could be tailored on other variables such as motivation to quit. Overall, tailored interventions have been found to be more successful than generic informational feedback (Kreuter, 1999; Noar, 2007).

The success of tailored messages is attributable to an underlying theory of behavior change by providing the framework of specific variables to focus on along the continuum of behavior change (Noar, 2007). The Transtheoretical Model (TTM) is a dominant theory in tailored communications for health behavior change (Prochaska & DiClemente, 1983). It has been well studied and applied to dozens of health behaviors including

smoking cessation, alcohol abuse, and obesity prevention (Hall & Rossi, 2008). The TTM is based on the decision making of an individual for intentional change. TTM identifies change as a process involving progress through a series of five stages; Precontemplation, when a person has no plans to change their behavior, Contemplation when a person has some intention to change their behavior in the future, Preparation when a person is intending to take action in the immediate future and they are making plans to change their behavior, Action when someone has actually made changes to their behavior, and Maintenance when someone has made significant changes in behavior and are using newly found coping skills to prevent a relapse (Prochaska & DiClemente, 1983). Progress through the stages is primarily seen as related to two other TTM constructs, Decisional Balance and Self-efficacy. Decisional Balance reflects how a person weighs the pros and cons of changing their behavior (Janis & Mann, 1977). Self-efficacy reflects the level of confidence that an individual has in their ability to make behavioral changes and maintain those changes under challenging circumstances (Bandura, 1977 & 1982). TTM and the supporting evidence suggests that tailoring on variables such as stage, readiness, decisional balance, and confidence are strong predictors of change.

The TTM provides a framework to guide computer-tailored assessment and interventions because it is designed to meet the needs of all participants, not just those ready for change. By using TTM, researchers can tailor interventions for a particular behavior by stage. For example, if someone is in Precontemplation for quitting smoking, TTM tailoring would focus on helping them consider quitting and thus progress to Contemplation rather than pressing them to quit right away and produce resistance to change rather than progress or help them move from Preparation, such as thinking about

and setting a quit date, to Action. Within each stage, TTM suggests processes of change that will help increase the awareness of pros by either increasing healthy behaviors or decreasing unhealthy behaviors (i.e., increasing the value of the pros of exercise or the pros of quitting smoking) and decreasing the importance of the cons (i.e., the cons of exercising or the cons of continuing to smoke). Also within each stage, TTM processes of change are tailored to stage in order to help build a person's confidence (i.e., their confidence in their ability to stop smoking in challenging circumstances). Tailoring interventions to stage of change reduces participant resistance to change and increases the likelihood of progress to Action

It is theorized that TTM-guided health promotion of a targeted behavior, like exercise, could both help an individual increase their healthy behavior and possibly reduce unhealthy behaviors (e.g., alcohol use). In sum, the evidence suggests that theory-based tailored interventions such as TTM-tailored computer-based interventions are the most successful at effecting behavior change (Noar, 2007). It also suggests a harm reduction approach might encourage an increase in positive and healthy behaviors (exercise) rather than solely focus on discouraging risk behaviors (alcohol) (Mauriello, 2010; Velicer, 2013). The goal of this project was to develop a program to assess for multiple behavioral health constructs and provide tailored feedback on a four constructs (two to promote healthy behaviors and two to reduce unhealthy behaviors) in a pediatric primary care setting and to evaluate the feasibility and utility of that program during and post implementation. To date, no one study has completely integrated behavioral assessment with a health promotion feedback intervention based on the TTM in a pediatric primary care setting.

B. Details of methods, instrumentation and techniques

Chapter 1.

Gathering Stakeholders

Four focus groups meetings were conducted with key stakeholders in health behavior change in pediatric primary care. The first meeting was in July, 2011 and included this writer, a public health professional and Ph.D. student in clinical psychology, who was interested in conducting a research study on the early intervention of behavioral health, as well as, Dr. Louise Kiessling, M.D., a pediatrician with 35 years of experience specializing in diagnosing and treating children with Attention Deficit Hyperactivity Disorder, and Susan Orban, a leader from the South County Mental Health Coalition for Children, an organization that exists to increase the behavioral health services in underserved rural areas in Rhode Island. The first meeting was convened to review and discuss expanding the results of a pilot project that was conducted to assess behavioral health in pediatric primary care (Femino et al., 2006). The authors, who presented findings at the 38th Annual American Society of Addiction Medicine Med-Sci Conference, reported preliminary findings on the project implementing screening and brief interventions in pediatric primary care. These authors developed a self-report screening tool for substance abuse, depression, anxiety and eating disorders among adolescents in primary care and trained staff on brief interventions for these constructs using Motivational Interviewing. The screening assessment was administered to adolescent patients at well care visits in paper and pen form. Physician scored the form in the office visit, discussed results with the patient and/or parent then provided brief treatment, education and referral as appropriate. The results indicated that the screening

instrument was easy to implement in a primary care setting. Providers also noted significant improvement in identification rates by using the instrument as compared with the clinical interview alone. Rates of identification and referrals also improved; however, providers noted significant problems with interference in office workflow, extension of office visit time and billing concerns. Primarily, the screening, scoring, and brief intervention procedure more than doubled the length of office visits. For future consideration, the authors suggested that severity of symptoms be assessed to determine appropriate intervention and referral. They also strongly suggested that caffeine and tobacco be added to a screening questionnaire.

At the initial focus group meeting, ideas were brainstormed to address the concerns that were noted in the Femino et al., 2006 pilot study. Suggestions including screening patients prior to seeing the doctor, using electronic devices to screen and potentially eliminating the physician delivered intervention. A second meeting was conducted to include Dr. Celeste Corcoran, M.D., the pediatrician whose practice participated in the Femino et al., 2006 study. The goal was to assess her interest in expanding the results of the initial pilot study, propose the suggestions identified at the first meeting and to identify her priorities for improved patient care regarding future study implementation. Dr. Corcoran supported the proposal for electronic assessment and intervention for rapid assessment and feedback. In addition, she identified assessment of nicotine use and caffeine use as a priority for any behavioral health assessment.

As a next step, the literature was consulted to investigate methodology for computer driven assessments and interventions in primary care. A preliminary proposal was presented to Mark Robbins, PhD, health psychologist and dissertation advisor. He

offered specific feedback on improving scientific methodology and provided expertise on the transtheortical model to be included in the intervention arm of the study. A third meeting convened with this writer and Dr. Corcoran to better understand the practice flow and the standard of care for assessment and treatment of behavioral health issues. The standard of care for behavioral health assessment was defined as the paper and pen assessment that had been adapted from the original pilot study to include one question on sadness, one question on anxiety and one question assessing eating behaviors. Substance use was measured using the CRAFFT; a behavioral health screening tool consists of a series of six questions developed to screen adolescents for high risk alcohol and other drug use disorders simultaneously in primary care (Knight et. al., 1999). CRAFFT is a mnemonic acronym of first letters of key words in the six screening questions. They are related to driving in a Car with someone intoxicated, use substances to Relax, using substances Alone, Forget things you did while intoxicated, Friends telling you that you should stop using, or you have been in Trouble while using alcohol or drugs (Knight et. al., 1999).

The standard of care for anyone having a positive behavioral health screen at Narragansett Bay Pediatrics was variable and was dependent on the type of issue identified, the severity level of the issue, the physician's perceived level of competency to treat such an issue, and/or resources to treat the identified issue. Patients were identified as having a positive behavioral health screen based on their responses on the NBP paper and pen assessment of behaviors. Examples of the potential treatment methods included physician administered educational handouts, brief motivational interviewing, medication and/or referral for outpatient mental health treatment.

At the conclusion of this third meeting, constructs emerged from the original assessment as being of primary importance to be included in any new measure development for multiple behaviors including depression, anxiety and eating disorders. Nicotine and caffeine use were also included based on the outcome of the pilot study (Femino et al., 2006) and based on Dr. Corcoran's belief that cigarette smoking and caffeine intake were prevalent and contributed to poor functioning among adolescents in her practice. The range of patients determined eligible for the study was anyone between the age of 13-21years old. A patient was ruled out if they were identified as having a developmental delay, if they were unable to read or did not speak English. Office staff was included in the third meeting to assess the possible utility of a tablet-based intervention in the office and to assist in building a theory-based intervention that supports the physician process. Questions were raised with staff members to understand the flow of patients in the practice. This included understanding patient wait times, length of a typical office visit, time spent on behavioral health questionnaire, various treatment methods, as well as what would be useful for physicians to see in an assessment feedback report. Physicians were asked whether they would like to have a reporting of severity of symptoms, duration of symptoms or motivation to change symptoms, and whether they would prefer electronic feedback or a hard copy paper format. Other ideas that were considered, in this idea generating phase, included connecting patients to an on-line system for further health promotion and whether staff would be interested in promoting healthy behaviors to patients (such as the benefits of exercise, stress management and eating healthy).

The fourth and final focus group meeting of stakeholders included Dr. Robbins and Dr. Corcoran to construct a potential timeline for assessment constructs, revisions to the assessment measure, system development, cognitive testing (testing a sub-set of the sample to ensure instructions, questions and feedback were understood prior to implementation), program implementation and summary evaluation. Program evaluation was projected to take approximately two years from the development phase to completion. Confidentiality, HIPAA laws, and protection of patient confidentiality were considered including whether or not patients should complete the assessment in a waiting area or in a private room, whether parents should be present when adolescents complete the assessment, and whether or not the data should be linked with a medical record. It was determined that research data would be kept confidential for the Physician/office staff. In this regard, Dr. Corcoran may, as part of her standard of care, print out the assessment results, write the patient's name on the assessment results and place it in a person's medical record. For the non-medical researchers (i.e., Signore, Robbins) participant data would have a de-identified identification number and therefore be anonymous.

Regarding participant recruitment and study procedures, Dr. Corcoran decided that she would personally recruit and consent (assent) potential participants since completing IRB research training and the conducting the consenting process was considered to be an additional time burden on staff. Dr. Corcoran also determined that she, with the assistance of her office manager, would collect and file consent forms in her office in a locked cabinet space that was separate and apart from electronic data recorded by the tablets. Office support staff (office manager, nurses and receptionists) were

consulted to assess the impact of a potential computerized behavioral health assessment on the office. It was determined that staff would need to be trained to understand the timing of recruitment and the consenting process, assessment administration and their role in facilitating the flow of an office visit with the computerized assessment. The needs of practice and practical considerations were assessed including the type of equipment that would be user friendly for patients and staff as well as hardware compatibility for the office to interface with the tablet -based assessment system. A separate meeting with Information Technology (IT) for the pediatric practice was conducted to determine necessary security features and system requirements. IT directed that a Microsoft Windows system was required to be compatible with office technology so that any future interface would be possible. Thus an Apple ipad would not be compatible. Research on potential tablets determined that a Surface Pro Microsoft Windows-based tablet computer would be secure, compatible with network and office software, user-friendly and still provide a platform that could be engaging for adolescent patients. IT also dictated that having patients connect to an on-line health promotions site via a link to additional feedback about behaviors would not be feasible due to security requirements. Concurrently, additional separate meetings were held with, Michelle Loxley, a computer programmer with several years of experience with program evaluation and developing assessment and intervention systems using a Microsoft Office platform (i.e., Microsoft Access). Ms. Loxley was consulted frequently in the planning phase of system development.

Chapter 2.

Conducting a Needs Assessment

A review of the literature finds that approximately twenty percent (20%) of all United States children will be diagnosed with a mental health disorder in a given year (Perou, 2013). Anxiety has the earliest onset (6 years), followed by behavioral disorders (11 years), mood disorders (13 years), and substance use disorders (15 years) (Merikangas, 2010). Early identification of mental health disorders is vital because often these children will be unsuccessful academically, have interpersonal difficulties with peers and are at risk for having adverse effects on functioning into adulthood (Kessler, 2009; Kieling, 2011). For example, adolescents with mental illness come into contact with the juvenile justice system more than 3 times as often as adolescents with no mental illness (Erikson, 2012). In addition, childhood mental health disorders have been linked to an increased risk of several chronic physical conditions later in life (Scott, 2011).

In the United States a significant percentage of children still lack availability, coverage, and access to mental health care (Bethell, 2011). It has been reported that even if a mental health disorder is detected in childhood, only one half of effected children will receive treatment with a mental health professional (Merikangas, 2010). Rates of treatment are even lower for those children with public insurance and further disparities have been reported according to race/ethnicity and socioeconomic status (Bethell, 2011). The low rates of detection and treatment even among children with private insurance indicate a system-wide breakdown in specialized care for children (Bethell, 2011). However, a national study investigating health care quality for children across states

found that states are responding by supporting policies to improve mental health outcomes (Bethell, 2011).

To date, the best estimates we have for childhood mental health disorders and treatment for these disorders come from large population studies. While these studies provide valuable information on the national population, there are limitations. Constructs such as depression are often assessed with only one question and the questions tend to be general enough to apply to a large number of people. In addition, some questions may be too difficult for participants to recall or too sensitive to answer truthfully. Furthermore, all questions are anonymous so there is no follow up or treatment offered (Barribeau, 2012). Finally, since a majority of the large survey studies differ in design, it is often difficult to make comparisons across studies. In a comprehensive review of several national surveys on childhood mental health, Perou et. al. (2013) reported that each independent surveillance systems had varying objectives, the samples differed and the methods were not the same. (Perou et. al., 2013). So, while national public health surveillance data systems are critical for tracking information related to mental disorders among children over time at a population level, there may be an underreporting of mental health rates and missed opportunities to increase early detection and access to treatment at the individual level.

The recent advent of electronic medical records has provided an opportunity to identify mental health problems early and to assess for treatment follow-up within health systems and electronic medical records are becoming increasingly common in pediatric primary care. A 2013 study showed an increase in EMR from 16% in 2003 to 52% in 2010 (Kokkonen, 2013). Current estimates reveal that 78 percent of office-based

physicians had adopted some type of EHR (Furukawa et. al, 2014). Physicians in private practice were slower to adopt EMR and pediatricians and have been especially underrepresented in the literature until more recently (Kokkonen, 2013). The benefits of EMR's are that they have the potential to follow and address the individual mental health needs of children as well as to provide systems level and local community prevalence data (Wasserman, 2011). This chapter examines the epidemiologic usefulness of electronic medical records in surveying local prevalence of mental disorders, and treatment statistics among adolescents in a pediatric primary care setting. The main objective of this needs assessment study was to assess the mental health needs among children in a primary care setting.

2.1 Methods

Participants

The participants in this study were patients of a large (7 physician) pediatric practice in the New England (N=6090). Those who were identified as having a positive mental health screen (N=1087) accounted for approximately 18% of the total patient population.

Procedures

One of the practicing pediatricians in the office used the electronic medical records database to search for and identify Current Procedural Terminology (CPT) codes for positive mental health screen for patients seen in calendar year 2011. An individual review of each patient's encounter was competed to identify demographic factors such as age, sex, insurance status and provider, referral status and medication prescription data related to the positive mental health screen. Once the database was gathered the

individual records were stripped of any identifying information such as name and patient account number.

The de-identified variables were entered into a Microsoft Access Database, coded, and imported into the statistical software package, SPSS 20. The data were reviewed to identify any missing and duplicate data and if so the medical record was consulted for clarification. for. Once the data were cleaned, similar mental health codes were combined. For example, Eating Disorder NOS, Anorexia and Bulimia were all combined to create an Eating Disorders Variable. All subtypes of Attention Deficit Disorder were combined to create an ADHD variable. Anxiety includes generalized anxiety and all specific phobias, but not OCD, which was kept as a separate category. Tourette's syndrome was combined with Tic Disorders to create one variable and all addictions were categorized as drug abuse. The final list of variables included 16 categories of diagnoses (Table 1).

2.2 Analyses

The frequency, mean, and prevalence of positive mental health screens were calculated. Data were aggregated for co-morbid combinations of positive mental health screens. The frequency, mean and prevalence of co-morbid positive screens were also calculated. Demographic data were stratified to examine differences between age, gender, positive mental health screens and co-morbid positive screens. Mental health prescriptions, referral status and type of insurance were also examined independently and by demographic variables. Comparative analyses were completed with data from a region (Great Smoky Mountain Study (GSMS)) with a similar demographic distribution

(Costello et. al., 2003) and for the most accurate comparative analysis a national sample with similar variables (age and diagnostic categories) was selected (NHANES, 2013)

2.3 Results

Eighteen percent of patients (N=1087) were identified as having a positive mental health screen). The mean age among those with a positive screen was 13 years, 60% were male and 100% had insurance (approximately 90% commercial; 10% public). Of those patients identified as having a positive mental health scree, 83% had private insurance and 17% had public insurance coverage.

The most prevalent primary diagnoses were ADHD (40%) and Anxiety (20%) (Table 1). The most prevalent dual positive screens were Anxiety and ADHD (3.65%) followed by ADHD and Developmental Delays (2.30%). There were a total of 76 comorbid combinations. Table 2 presents the ten most prevalent comorbid positive screens. Among participants with multiple positive screens, a significant proportion of 5-9 year olds (33%) were dual diagnosed with ADHD and anxiety. However, even when the mental health positive screen variable was aggregated to look at multiple positive screens, ADHD remained as the most prevalent diagnosis (6.37%) followed by anxiety (2.35%).

Among patients with a positive screen of ADHD, 66% were male and the majority of patients were between 13-18 years (53%), 32% were between the ages of 5-9 years and 71% of patients with a positive screen of ADHD received a prescription for ADHD medication therapy and 64% were referred for specialist treatment with either a psychiatrist or a psychologist. The highest percentage with a positive screen of Anxiety, were between the ages of 13-18 years, 29% were between 5-9 years and 18% were 19

years or older. Approximately half (45.2%) of patients with a positive screen of anxiety were prescribed medication and 75.3% were referred for specialist treatment.

Comparing these finding with NHANES data and the GSMS data (Costello et. al., 2003), using a 12-month period prevalence reference point, we found that the rates of having any positive mental health screen were similar 10.11%, 13.1% and 13.3% (Signore et. al, NHANES, and Costello et., al., respectively) (Figure 1). With respect to specific positive screens, our sample had similar rates of anxiety (2.02%) as compared with the GSMS (2.4%) (Costello et.al, 2003) and ADHD was the most prevalent positive screen for our sample (4.56%) as it was the most prevalent with the national sample (8.6%). However, we found less depression (.45%) among our participants as compared with the GSMS (2.2%) (Costello, 2003) and the national sample (2.7%) (NHANES). In addition, Conduct Disorder was lower (0.21%) in our sample as compared with the GSMS (2.7%) (Costello et.al.) and the national data (2.1%) (NHANES).

2.4. Discussion

It was encouraging to find results that were similar to what others have reported for this population. The key differences were with respect to some of the specific positive mental health screens and that may be attributable to measurement and/or analyses. For example, Depression with Anxiety in our sample was a separate category and therefore not included in the analysis of depression. This may have led to the lower rate of depression in our sample. Similarly, Conduct Disorder is not routinely screened for in our sample and positive screens may have been missed resulting in an underrepresentation of this diagnosis in our sample. More surprising were the lower rates of ADHD diagnoses among the GSMS (Costello et. al., 2003) and the low rate of Anxiety reported in NHAMES data. These discrepancies may have to do with measurement of these disorders

or the fact that they may be unaccounted for among those with comorbidity. The determination of this discrepancy is beyond the scope of this paper, but warrant further investigation.

In our sample, it was unexpected to discover that approximately 25% of all patients with anxiety did not receive a referral and that primary care doctors are treating a significant number of children with mental health problems as young as five years old. These finding highlight the importance of (1) understanding the needs of patients within a group (2) routinely monitoring those needs to assess for and improve quality of care and (3) electronic medical records can be a tool used to assist in the early identification of mental health needs and (4) EMR should be designed to track follow-up and treatment rates for physicians.

A major strength of this study is that we were able to identify patients with a positive mental health screen in a manner that was fairly quick and easy. We were able to demonstrate that EMR can be an important tool used to assist in improving medical care, follow-up and outcomes for mental health services for children. In the future, if developed properly, EMR could also be a tool for data collection, potentially making it more efficient for physicians to track patient follow-up, treatments and outcomes. A well designed EMR system could also benefit researchers and policy makers to collect longitudinal data on the epidemiology of mental disorders in a community.

Unfortunately, however, most EMR systems are not designed to collect data (Wasserman, 2011). A review of progress using EMR for pediatric clinical research found several issues using EMR data including comparability between settings, accuracy of records, completeness of records, ease of extraction, and context of recording

information (Wasserman, 2011). Another study reported a dissatisfaction with electronic health records among some providers and called for investigators to document the challenges in working with EMR as well as suggestions for improving implementation of EMR (Buntin, 2011).

In this study, there were limitations to data collection. The system was not designed to query for mental health diagnoses and required the physician to search for similar CPT codes. In addition, once patient were identified, the physician had to search through each patient's electronic record to extract study variables. The physician then had to verify the extracted information. This was laborious and time consuming process. Furthermore, since other practices have different systems and there is no consistent way to collect data across practices, making comparisons difficult. Other limitations to this study include the fact that it was descriptive in nature which means the results may not generalize to other populations.

It was suggested by Wasserman et. al. (2011) that longer-term solutions will involve work with pediatric clinicians to improve data quality before outcomes research becomes one of the explicit purposes for which pediatricians collect EMR data, but that the pediatric clinician will play a central role in future pediatric EMR development and clinical research. We agree that there needs to be cross-discipline collaboration with primary care physicians, researchers and EMR system developers to establish methods of quality of care monitoring. The development of an intervention that screens for behavioral health at well care visits and is able to interface with the office's electronic medical records would be optimal.

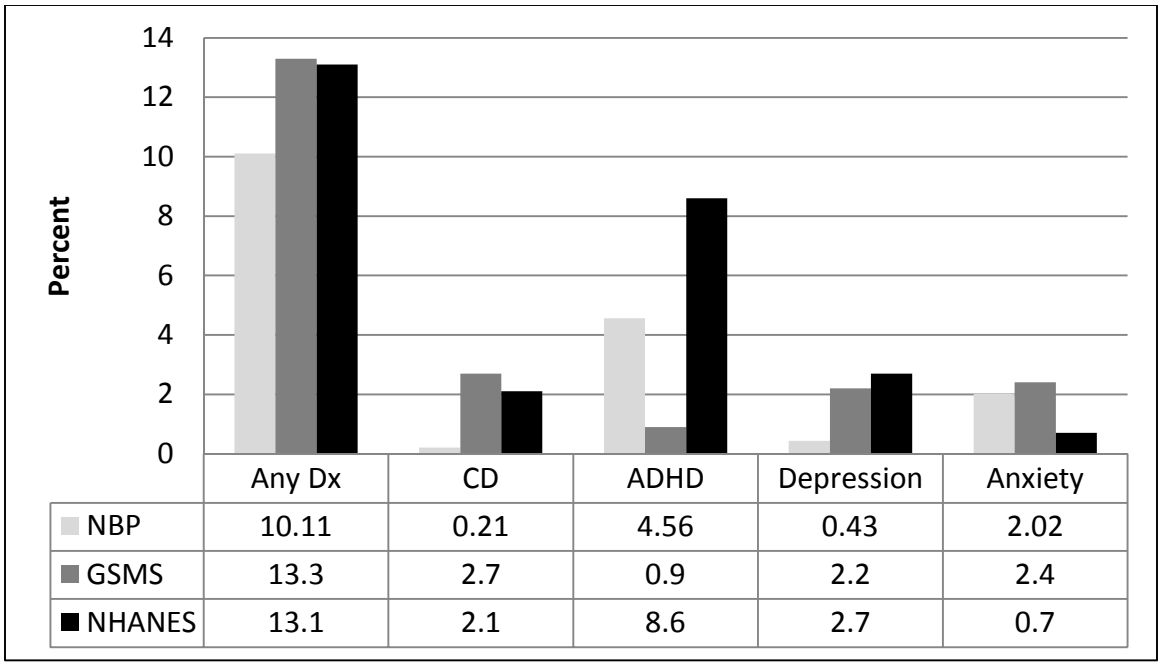
Table 1. Percent of sample (N=1087) by primary positive mental health screen

Diagnosis	Percent (%)	Positive Screen	Percent (%)
ADHD	40.2	Down's syndrome	1.2
Anxiety	20.1	Drug Abuse	0.8
Autism/Asperger's	7.2	Eating Disorder	3.6
Bipolar	0.8	Neurofibromatosis	0.1
Conduct Disorder	2.1	OCD	0.2
Depression	6.5	PTSD	0.4
Depression with Anxiety	2.8	Sleep Apnea	0.7
Developmental Delays	9.0	Tic Disorders	4.2

Table 2. Most Prevalent Comorbid Positive Screen

Primary Screen	Secondary Screen	Tertiary Screen	% MH PS
Anxiety	ADHD		3.65
ADHD	Developmental Delays		2.30
Depression	ADHD		1.01
Autism/Asperger's	ADHD		1.01
Tic Disorders	ADHD		0.82
Conduct Disorders	ADHD		0.55
Depression with anxiety	ADHD		0.46
Autism/Asperger's	Anxiety	ADHD	0.37

Figure 1. Comparison of Narragansett Bay Pediatric (NBP) 12-month prevalence data (8-16 years)* National Health and Nutrition Examination Survey (NHANES) 12- month prevalence (8-15 years),** Great Smoky Mountain Study (GSMS) 3-month prevalence (9-16 years)***



	Any Dx	CD	ADHD	Depression	Anxiety
NBP	10.11	0.21	4.56	0.43	2.02
GSMS	13.3	2.7	0.9	2.2	2.4
NHANES	13.1	2.1	8.6	2.7	0.7

*NBP from Signore et. al, 2013
**NHANES data http://www.nimh.nih.gov/statistics/1ANYDIS_CHILD.shtml
***GSMS data from Costello et. al., 2003

Chapter 3.

Program and Evaluation Design

3.1 Assessment Development

The initial steps in program evaluation described the process of identifying the behavioral constructs to be included in a new measure by completing focus groups with key stakeholders, examining data from a previous pilot study, examining existing measures within the pediatric practice, and discussing office needs with staff members. Chapter two confirmed the importance of identifying behavioral health problems in primary care, identified potential gaps in screening for such problems and predicted the usefulness of electronic data collection. The next phase of program development included a complete review of existing measures for the behavioral health constructs that were to be targeted for this project. This evaluation design component included a description of how the pediatric assessment previously employed in the target primary care office was revised to create a new, brief, assessment for mental health and behavioral health behaviors that would be appropriate for implementation in pediatric primary care for patients age 13 to 21 years of age.

3.1.2 A review of the constructs

To review, in 2005, a large pediatric practice in the Northeast (Narragansett Bay Pediatrics) instituted a paper and pen assessment for several mental and behavioral health of patients between the ages of 13-18 years [see appendix]. The practice physicians created, and piloted, a non-validated measure to assess for mental health behaviors that they thought were important as treating physicians and were relevant to their adolescent patient population (Femino et al., 2006). For clarity, the measure the physicians were

using prior to this study will be referred to as the NBP measure. At the initial key stakeholder meeting, described previously, physicians indicated that they wanted to continue to collect information on these same constructs that were measured with the NBP measure, and so this measure was used as the starting point for assessment revised assessment. Initial goals for revision of the NBP measure included assessing for additional behaviors such as nicotine and caffeine use, assess for alcohol and marijuana use separately, create questions based on validated measures and use scales that are consistent, and meaningful.

The redesign of the NBP began with research meetings conducted with research staff and committee members for this dissertation study. Adding assessments of sleep quality and quantity and caffeine use were suggested for inclusion in the updated behavioral assessment measure given research that poor sleeping habits (McKnight-Eily et al., 2013) and excessive caffeine use (Calamaro et. al., 2009)) may contribute to behavioral difficulties and could lead to a misdiagnosis if not assessed properly. Literature review also indicated that Eating Disorders (Swanson et al., 2011) are prevalent among adolescents and questions assessing disordered eating patterns should be included in the measure. The practice physicians also felt disordered eating were important for inclusion since given their relation to high morbidity and mortality. To assess for substance use more completely using distinct categories, the CRAFFT (Knight et al, 2002) was eliminated and other validated substance uses measures were evaluated. The procedure for evaluation for each mental and behavioral health construct is described in section 3.2.

In sum, the final constructs included for evaluation for inclusion in a newly revised behavioral assessment NBP-R were operationalized to include mood (depression,

anxiety, and irritability), sleeping habits, eating habits, exercise habits, stress management, smoking, caffeine use, alcohol use and marijuana use.

3.1.3 Review of Existing Measures

No one brief measure exists to assess for the most prevalent mental and behavioral health constructs. Several self-report measures and clinician administered measures exist to assess the mental health of adolescents. The self-report measures are designed to screen for symptoms while the clinician administered measures are designed to aid the clinician in making a formal diagnosis. In a primary care setting, the goal is to use a valid multi-behavior measurement tool to assess patients as rapidly as possible prior to meeting with the doctor. As such, for the purposes of creating a multi-behavior assessment, validated measures were evaluated for each individual mental or behavioral health construct to determine which would be most appropriate for use with teens in a primary care setting or, if none existed, which could be adapted for use in primary care. The strengths and weakness of the selected measures were evaluated including weighing of the level of psychometric properties, comprehensiveness with length of administration and meeting project goals of brevity and clarity. Below a summary of the literature findings for each construct are reported. The selection of final assessments questions is discussed in the next section 3.3.

Depression. Many measures exist and were considered to assess for possible depression in adolescents. **The Beck Depression Inventory (BDI)** is the most widely used measure to assess for depressive symptoms (Beck et. al., 1988). The original 21-item measure has been modified to a brief 13-item short form and takes approximately five minutes to complete (Beck et. al., 1996). The BDI has been demonstrated to have

strong psychometric properties to assess for depression among adolescents (Ambrosini et. al., 1991). However, the BDI, which was originally created for adults, may result in false-positive rates among adolescents (Young et. al., 2010). Another common screening measure is **The Children's Depression Inventory (CDI)** (Kovacs, 1992). The CDI was originally a 27-item measure validated for use with children ages 7–18 that has been shortened to a 10-item scale (Kovacs, 2005). Although the CDI has good reliability data, there are concerns about its construct validity with research suggesting that the CDI measures general distress rather than true depression (Young et. al, 2010). Another common measure of depression for children is **The Center for Epidemiologic Studies-Depression Scale (CES-D)** (Radloff, 1977). The CES-D is a 20-item self-report measure of depression that was also originally developed for adults, but has been well researched and tested as a screening tool for adolescent depression (Roberts et. al., 1990; Young, 2010). A particular weakness of the CES-D, is that it leads to even greater false positives in adolescents than the BDI and takes slightly longer to administer with nearly double the amount of questions (Young, 2010). **The Reynolds Adolescent Depression Scale (RADS-2)** is another well-known measure of adolescent depression (Reynolds, 2005). The RADS-2 is the longest self-report measure containing 30-items. The RADS-2 scale is based on the diagnostic criteria for depression and may prove to be a more reliable measure of depression than other assessment measures, but additional research is needed before that can be determined. Finally, the most recent self-report measure published is **The Kutcher Adolescent Depression Scale (KADS)** (Kutcher, 2003). The original KADS was a 16-item instrument, but was more recently revised to a short 6-item scale (Kutcher & Chehil, 2007). Compared with the BDI the short 6-item KADS was found to

be equally effective at assessing depression in adolescents and may be more a more efficient means of ruling out depression in a primary care population (LeBlanc et. al., 2002).

Anxiety. Six self-administered measures were located for the assessment of Generalized Anxiety Disorder among children between the ages of nine and nineteen. **The Screen for Child Anxiety Related Disorders (SCARED)** is a valid and reliable screening tool for children and adolescents age 8 and older for anxiety disorders in a clinical setting (Birmaher et. al., 1999). The SCARED contains 41 items that measure five factors: general anxiety, separation anxiety, social phobia, school phobia, and physical symptoms of anxiety and only takes five minutes to administer (Birmaher et. al., 1997). A reduced version of the SCARED yielded 5 items and showed similar high validity and reliability as compared with the full SCARED (Birmaher et. al., 1999). **The Spence Children's Anxiety Scale** (Spence, 2003) is a 38 item anxiety scale that measures separation anxiety, social anxiety, obsessive compulsive, panic/agoraphobia, physical injury fears, generalized anxiety with questions scored using a 4-point scale of 'never', 'sometimes', 'often', or 'always'. There is no set time period over which the judgement has to be made. The Spence has been found to have extremely high internal consistency (reliability) of the total scale ($\alpha = .93$). Test retest scores were also reasonably high (coefficient of .60 after 6 months) (Spence, 2003) and it has been tested with a normative population of 7-19 years (Spence, 2003; Muris et al., 2000). **The Multidimensional Anxiety Scale for Children (MASC)** is a 50-item measure that aids in the early identification, diagnosis, treatment planning and monitoring of anxiety-prone youth aged 8-19 years (March et al., 1997). It contains six scales and four subscales

related to anxiety disorders (e.g., Separation Anxiety/Phobias, GAD Index, Social Anxiety, Obsessions & Compulsions, etc.) and takes approximately 15 minutes to complete. The MASC demonstrates good psychometric properties and clinical utilities in identifying youth with anxiety disorders, but is lengthy (Wei et al., 2013). **The Revised Children's Manifest Anxiety Scale (RCMAS)** is a 49 item validated and reliable measure with yes/no responses that include five scales (i.e., Physiological Anxiety, Worry, Social Anxiety, Defensiveness & Inconsistent Responding) (Castaneda, et al., 1956; Reynolds, & Richmond, 1985). The RCMAS takes approximately ten minutes to complete and it is suitable for children aged 6-19. **The Beck Anxiety Inventory for Youth (BAI-Y)** with 20 items that reflect children's fears, worrying, and physiological well-being scaled from 0 (Never) to 3 (Always). The BI-Y takes five minutes to complete and is validated for use with children and adolescents ages 7 through 18 years (Jolly et al., 1993; Beck et al., 2001).

Irritability. The somewhat general term, irritability, can be a symptom of several underlying disorders such as Autism, Conduct Disorder and Bi-polar, but little research has been conducted on the assessment of irritability in adolescents. One emerging measure of irritability in children was recently published called **The Affective Reactivity Index (ARI)** (Stringaris et al., 2012). The ARI assess whether patients have been "feeling irritated or easily annoyed" and/or "feeling angry or lost your temper" during the past 6 months with seven questions using a three-point scale of not true, somewhat true and certainly true. The measure was validated for use with children aged 11–17 years and found to be a reliable measure of irritability in clinical settings and is easy to use (Stringaris et al., 2012).

Conduct Disorder. **The Reynolds Adolescent Adjustment Screening Inventory (RAASI)** (Reynolds, 2001) and the **Conduct Disorder Scale** (CDS) (© 2012 PRO-ED) are both available for purchase, and report psychometric validity, but have no supporting peer reviewed publications. The CDS is a 40- item checklist for conduct disorders in individuals ages 5-22. The CDS assesses aggressive and non-aggressive conduct, deceitfulness, theft, and rule violations and takes 5-10 minutes to administer (© 2012 PRO-ED). The RAASI is a 32-item (5-minute) self-report screening measure of psychological adjustment for use with adolescents ages 12-19 (Reynolds, 2001). There are four scales: antisocial behavior, anger control problems, emotional distress, and self-esteem and social inhibition and limited evidence of validity and reliability (Reynolds, 2001).

Sleep. Four self-report sleep measures have been identified as validated for use with adolescents. **The Adolescent Sleep Wake Scale (ASWS)** is a 28-item one-month retrospective assessment using five subscales: going to bed, falling asleep, awakening, reinitiating sleep, and wakefulness (LeBourgeois et al., 2005). The ASWS was reported to be reliable (whole measure $\alpha = .86$ and subscales: $\alpha = .64–.82$) and valid by multiple studies (Lewandowski et al., 2011; Spruyt & Gozal, 2011). **The Adolescent Sleep Hygiene Scale (ASHS)** measures sleep practices among 12–18 year olds (LeBourgeois et al, 2005). It is a 28 items measure with 9 domains reliability was reported with a total: $\alpha = .80$ and subscales: $\alpha = .46–.71$. **Sleep Habits Survey (SHS)** measures usual sleeping and waking on school and weekend nights, school performance, daytime sleepiness and sleep/wake behavior problems among 10–19 year olds (Wolfson & Caskadon, 1998, Wolfson et al., 2003). It is a 2-week retrospective assessment with 63 items and 3

subscales. It is reliable and was validated by correlating with both bio-measure of rest/activity cycles, but associations were greater for school-night variables than weekend nights (Wolfson et al., 2003). **The Cleveland Adolescent Sleepiness Questionnaire (CASQ)** measures daytime sleepiness as well as day and nighttime alertness among 11–17 year olds (Spilsbury et al., 2007). It is a 16 items measure with a total reliability $\alpha = .89$ and validity correlation and convergent validity with other sleep measures, but has been less researched than the other measures (Spilsbury et al., 2007).

Disordered Eating. There are few self-report assessment measures for adolescent eating disorders. **The Eating Attitudes Test (EAT-26)** was originally designed for use with adults and is the most widely used measure to assess eating disorders. The original assessment included 40 questions, but has been shortened to 26 questions. Even among adolescents it is preferable because it was designed to be brief for use in research and primary care settings (Garner et al. 1982; Micali & House, 2011). Subscales include dieting food preoccupation and self-control. Scores are summed to determine whether a person is at a likely, probable or unlikely risk for an eating disorder and takes about ten minutes to complete. The EAT-26 has been used with older adolescents but is not suitable for use with younger children (Maloney et al., 1988). **The ChEAT** is a simplified version of the EAT-26 questionnaire and was developed specifically for use with young people aged 8-13 years, but has not been validated for use with adolescents (Maloney et al., 1988). The ChEAT is also limited by high rates of false positives and false negatives and its inability to distinguish between cases of anorexia nervosa and bulimia nervosa (Micali & House, 2011). **The Eating Disorder Inventory (EDI)** is a comprehensive screening instrument suitable for use in non-clinical populations (Garner,

1991). However, the assessment is long consisting of 91 items, which map on to 11 scales. A children's version of the EDI (the EDI-C) was developed by modifying the wording of some of the items of the EDI to make it more user-friendly for younger patients, but there are reported inconsistencies with regard to the reliability of some of the subscales for use with adolescents (Eklund et. al., 2005).

Exercise. Approximately 100 measures have been identified to assess level of physical activity among children (Biddle et. al, 2011). In a review by Biddle et. al., an expert panel of international exercise scientists supported twenty of those assessments. Out of twenty, eight were identified as assessing physical activity of adolescents specifically. The rest assessed the activity of younger children only. Two of the eight were found to have highest level of validity. **The School Health Action, Planning and Evaluation System (SHAPES)** Physical Activity Questionnaire, which measures the amount of moderate activity during the past seven days using a times calendar and was reported as having the strongest validity with moderate reliability, but it has a very long administration of twenty minutes (Wong et. al., 2006). The second, an exercise measure used in a study published on cardiovascular risk in young Finns (Raitakari et. al., 1997), was found to have moderate validity and strong reliability. This brief five items measure assesses habitual leisure time physical activity, sports and competition-level activities from ages 3-18 years (Raitakari et. al., 1997). One additional self-report measure of physical activity among 13-20 year olds, **The Physical Activity Questionnaire for Adolescents (PAQ-A)**, measures past 7 days total activity, but has reported weaker concurrent validity than the other measures evaluated (Kowalski, 1997). Finally, an older validated three 3-item scale called **The Leisure Time Exercise Questionnaire** has been

used and accepted in primary care settings to measure exercise habits (Godin and Shephard's, 1985). The measure asks respondents to indicate the level frequency for mild, moderate, and strenuous exercise they participate in during a typical week yielding an overall weekly activity score. It has been validated for use with adolescents (Sallis et. al., 1993).

Stress and Coping. There are many elements to defining and measuring stress management that a full discussion of the relevant constructs and measurement techniques is beyond the scope of this review and evaluation. Summarized here is an evaluation of self-report measures to assess general stress and/or coping that were either classified as well-established or approaching well-established for use among adolescents. **The Coddington's Life Events Scale for Adolescents (CLES-A)** measures the experience of certain life stressors in the past year at four time periods. It is the only measure found that measures stress alone, without assessment of coping responses, and was reported to be valid among depressed and runaway youth (Coddington, 1972). **The Children's Hassles Scale and Children's Uplifts Scale** is a self-report measure of stress and coping among healthy children 8–17 years old (Kanner et al., 1987). It assesses 25 hassles and 25 uplifts that may have occurred in the past month. Factor analysis derived subcomponents include peer comparison, parent, school, and family for the hassles scale (α =.62–.73), and parent, peer comparison, school, and sibling for the uplift scale (α =.54–.73). **The Rhode Island Stress and Coping Inventory (RISCI)** is another measure of stress and coping that was developed to examine perceived stress and coping independent of stress situations (Fava, et. al., 1998). The original factor analysis was conducted and validated with an adult sample (Fava, et. al., 1998). However, the x-item scale was subsequently used

successfully with a sample of adolescents (Mauriello, 2010). The remaining measures are coping assessments. **A-Cope** is a 52-item, 12 scale, measure designed to assess general coping among healthy adolescents aged 11 and up (Patterson & McCubbin, 1987). Internal consistency for the A-Cope was reported at α =.50 to.75 (median =.72) and test-retest reliability (r =.83) with high predictive validity (Blount, 2008). **The Coping Response Inventory** – Youth Form is a 48 items, eight subscales measure for healthy and depressed teens that asks about coping preferences (Ebata & Moos, 1991). It has reported internal consistency of α =.55 to.79 and test–retest reliability (r =.29 to.34) and approaching predictive validity (Blount, 2008). **Coping Strategies Inventory (CSI)** is a 32 items; eight primary subscales, four secondary scales and two tertiary scales self-report measure for children ages 7 and up (Tobin, 1991). Internal consistency was reported at α =.70 to.94 and test–retest reliability (r =.67 to.83) for same stressor and (r =.39 to.61) with two different stressors (Tobin, 1991). It was also reported to have convergent and predictive validity (Blount, 2008). **Ways of Coping** is a 68-item measure with eight subscales assessing general coping that has been used widely among children, adolescents and adults (Folkman & Lazarus, 1980). Internal consistency was measured at α =.61 - .88 for subscales. Test–retest was not reported (Folkman & Lazarus, 1980).

Nicotine Use. **The Fagerstrom Tolerance for Nicotine Dependence (FTND)** is a widely-used and validated 8-item measure of nicotine dependence that can be self-administered relatively quickly in a primary care setting to quantifying the degree of dependence on tobacco and it has been validated for use with adults and adolescents (Healtherton, 1991). **The Hooked on Nicotine Checklist (HONC)** is an alternative assessment tool that is often used for assessing teen tobacco use (DiFranza, et. al., 2002).

A comparison of study of the FTND and the HONC found that of the measures correlated similarly with age at smoking onset and days smoked per month, but the FTND correlated higher with cigarette consumption (Wellman et. al., 2006). However, the HONC had advantages over the FTND in that it measures a clearly defined construct, and each item has face validity; and it has better psychometric properties, greater sensitivity to the onset and low levels of dependence, and easily interpretable scores (Wellman, 2006). **The Time Line Follow Back** was originally developed to assess for nicotine use among adults (Sobell and Sobell, 1992) and was subsequently found to be a valid and reliable measure of nicotine use among adolescent smokers (Lewis-Esquerre, et. al., 2005). The time line follow back is a standardized calendar-prompted, retrospective measure of nicotine that can be interviewer administered, self-administered or computer administered (Rueger et. al., 2012).

Caffeine Use. Assessments for caffeine use have been less developed in the research literature. There are several articles that discuss calculating caffeine intake. Caffeine consumption is generally assessed by asking about average daily consumption of caffeine-containing drinks, that is, caffeinated soft drinks, tea, and coffee and converted into an average daily caffeine intake. Standards include a cup of coffee; 100 mg of caffeine; a can of cola; 40 mg of caffeine and an energy drink; 80 mg (Penolazzi, 2012; Kendler et al, 2008; Pollak & Bright, 2003)

Alcohol Use. In 2008, the Journal of Child Psychology and Psychiatry published a summary of alcohol assessment tools for adolescent alcohol use (Perepletchikove et. al., 2008). In the review by Perepletchikove et. al., thirty-five self-administered valid and reliable instruments were described. The assessments were divided into three categories;

(1) assessment, (2) diagnostic and (3) expectancy, motivation and self-efficacy questionnaires which ranged from 5 items to 1,606 items and had administration times ranging from two minutes to two hours (Perepletchikove et. al., 2008). Focusing solely on self-assessment of alcohol use, and excluding measures of dependence, four measures met criteria for being valid and reliable for use with adolescents to measure substance use and are able to be conducted in twenty minutes or less. First, **The Alcohol Use Disorders Identification Test (AUDIT)** seeks to identify harmful alcohol consumption before established dependence (Baboret al., 1992). It consists of 10 items and can be completed in two minutes. Second, **The Personal Experience Screening Questionnaire** assesses substance use severity and history, associated psychosocial problems and response distortion tendencies (faking good and faking bad) (Winters, 1991). It contains 40 items and can be administered in 10 minutes. Third, **The Substance Abuse Subtle Screening Inventory for Adolescents** has 100 questions and administration takes between 10–15 minutes (Miller, 1985). It assesses alcohol use and also includes four subtle scales designed to identify abusers who are attempting to minimize their substance use. Fourth, the **CRAFFT** tool, which was described previously, is a behavioral health screening tool that has been validated for use with children under the age of 21 (Knight et. al, 2001). It consists of a series of 6 questions developed to screen adolescents for high risk alcohol and other drug use disorders simultaneously using a mnemonic acronym of first letters of key words in the six screening questions. Another method that is used frequently in research, and is recommended by the World Health Organization as a reliable measure of alcohol consumption among teens, is the **Graduated Frequency (GF) Method**. This measure assesses drinking patterns and volumes consumed (WHO,

2000). The GF approach asks respondents how often they drink various quantities of standard drinks during a certain period (e.g., one to two drinks, three to four drinks, and so forth). This measurement tool often includes the cumulative frequency approach by first asking the largest quantity of drinks consumed during the reference period; then patients are asked about the frequency of consuming all the quantity categories that include or are lower than the reported maximum (Greenfield, 2000). Although there is no validated measure for this method, it has been used extensively in research and in treatment interventions for problem substance use.

Marijuana Use. Only within the past decade has there been a special focus on marijuana-specific assessment tools, with a preference for brief, low-cost instruments with good psychometric properties for use in busy clinical settings. Some of the earlier assessments were too lengthy to be administered in a busy practice including the 149-item **Drug Use Screening Inventory (DUSI)** (Kirisci et. al., 1995), the 139-item **Problem Oriented Screening Instrument for teenagers (POSIT)** (McLaney et. al., 1994) and the 40-item **Personal Experience Screening Questionnaire (PESQ)** (Winters, 1991). Other assessments vary with their generic focus on use of "drugs" and their reliance on only one or two marijuana items making them less sensitive to low-levels of use (Bashford, 2010). A review on marijuana measurement reported on the psychometric properties of three brief screening scales to assess problematic cannabis use specifically, which may be appropriate for use in primary care (Piontek, et. al., 2008). First, the revised **Cannabis Use Disorders Identification Test-Revised (CUDIT-R)** was reported to be valid and reliable for use with adolescents and it had high sensitivity (91%) and specificity (90%) (Adamson et al., 2010). However, two items; cannabis related

injury (item 9) and usual hours being stoned (item 2) performed very weakly in tests of reliability and construct validity on the CUDIT-R (Piontek et. al., 2008). Second, the **Cannabis Abuse Screening Test (CAST)** had high internal consistency very high sensitivity and specificity when compared with the longer 139-item POSIT (Legleye et. al., 2007). The CUDIT-R and the CAST were reported to be comparable measures of marijuana use among adolescents (Piontek, et. al., 2008). Third, the **Use of Marijuana (PUM)** is an 8-item brief measure with yes no responses that was designed for use with adolescents to measure harmful marijuana use along with problems in interpersonal relationships and psycho-physical functioning (Okulicz-Kozaryn, 2007). **The Time Line Follow Back (TLFB)** has also been adapted for marijuana use and is a reliable 30-day retrospective measure of marijuana use among adolescents (Lewis-Esquerre, et. al, 2005).

3.1.4 Creating a new brief multi-behavior assessment

The target time goal for administration of a mental and behavioral health assessment in primary care is ten minutes. An ideal new measure would be created to include all eleven constructs in the most time efficient yet comprehensive manner possible. The gold standard would be to use a measure that was valid and reliable for each construct area. The challenge was to determine the most valid and reliable way to assess all of the identified constructs as accurately and briefly as possible. Validity determines how accurately a measure is assessing a construct and can be achieved by looking at content, construct, predictive and concurrent validity. Reliability is the consistency with which a measure assesses a construct. For example, correlation calculations are used to assess the reliability of the test, and while there is always some level of error to measurement, the goal is to minimize that error by selecting items and measures that are both reliable and valid.

In creating a new measure for the NBP primary care office, the original NBP assessment was used as the starting point [see Appendix]. The NBP measure was never tested for validity or reliability, but the strengths of the existing NBP measure are that it is a self-administered measure of several constructs of interest with succinct questions (1-2 items) per construct. It also uses one validated measure for the assessment of substance use; the CRAFFT (Knight et. al, 2002). The CRAFFT, while a validated measure of substance use, also has its own limitations. It does not assess for alcohol and marijuana use specifically rather it lumps all substance use together and therefore may not be a reliable measure of either alcohol or marijuana use. Additional weaknesses of the NBP assessment include construct questions have not been validated, no consistent response scale, some responses are scored differently and some questions only account for current behavior and do not assess for past or lifetime behaviors. Therefore, the goal in creating a new assessment was to update the NBP measure to build from or utilize the existing valid and reliable measures that have been summarized for each mental and behavioral health area. To accomplish this, the NBP required several modifications. First, questions were added to assess for five additional constructs (sleep, caffeine use, physical activity, stress management and marijuana use). The original questions were revised and updated to be consistent with previously validated measures and with scales that are easily scored and interpreted. All measures were selected as self-report and the reading level was deemed appropriate for use with adolescent patients. As the NBP-R assessment was designed primarily as a screener that could prompt physicians to either conduct further assessment themselves or refer to specialists for assessment and possible treatment, brevity was key.

The first construct added was to assess sleep habits. Assessing sleep quality and/or quantity is not one of the constructs that neither the physicians nor the researchers wanted to focus on with longer assessment measures at this time or for intervention purposes. Sleep quality/quantity was then assessed as a baseline question of average number of hours slept, to briefly assess for possible sleep problems, and to assist in making a differential diagnosis. To accomplish this, patients are asked to report their average sleep and wake times. This was preferred over longer assessment measures for sleep problems and was also preferred over asking patients to calculate average hours per night they sleep, which could be inconsistent.

The second construct added was to assess caffeine intake. Similar to sleep, assessing for caffeine intake was not one of the high priority constructs for focus with longer assessment measures at this time or for intervention purposes. Caffeine intake was then assessed as a baseline question of average amount of caffeine intake per day, to briefly assess for possible caffeine problems, and to assist in making a differential diagnosis. Caffeine intake was assessed using the statement; "I currently drink this amount of caffeinated beverages per day (coffee, cola and energy drinks) with a 5-point response scale that starts with more than 8 cups and moves down in range to 0 cups. This approach is consistent with the published reports on assessing caffeine intake. Caffeine scores will be calculated by multiplying the average mg/cup (73mg) (Mayo Clinic, 2013) by the number of drinks per day.

Assessments for exercise and stress management were added as a prevention intervention and mechanism to promote healthy behaviors. The strongest research

supports the idea that adolescents benefit the most regarding mental and behavioral health problems by focusing on health behaviors rather than focusing on problem symptoms.

Based on the literature review, 60 minutes of exercise per day is the standard amount necessary for maximum health benefits. This is a construct that is part of the intervention and therefore needed to be assessed completely. Two validated and well researched measures on physical activity were modified (Raitakari et al; Godin and Shepard, 1985) to include the following questions; "in a typical week, how many days do you do complete 60 minutes or more of physical activity? Respondents are able to answer on a scale of 0-7 days. The exercise score will be the number of days the patient participates on 60 minutes of exercise per day in the past seven days.

The fourth construct added to assess for stress management by asking a series of twelve questions from the RISCI (Fava, et. al., 1998). This was the most comprehensive, yet shortened assessment measure of stress and coping together. The longer version was modified to 12-items assessing how various statement of stress and coping were true in the last month with responses that range from "never" to "frequently" on a five-point scale (Fava, et. al., 1998). Patients were categorized as having high, moderate or low levels of stress and/or coping. The RISCI was the briefest validated measure for stress and coping.

The fifth construct that was added to the original NBP assessment is the assessment of marijuana use specifically. The original NBP assessment used the CRAFFT, which combined use of alcohol and drugs (Knight, et al., 1999). Marijuana is an assessment construct that will be used to provide feedback in the intervention arm of the study. The revised questionnaire assesses whether patients have ever tried marijuana

(Yes/No). Then, the Time Line Follow Back method (Sobell and Sobell, 1992) was used to assesses how many times a patient has used marijuana in the past 30 days with the scale (0, 1-2, 3-9, 10-19, 20-39 or 40+ times). This method was selected because it has been shown to be a very effective way to measure quantity of use quickly and accurately. A score of zero means they are not a current user. Any other score indicates a current user with 10+ days indicating moderate use and 20+ times indicating heavy use.

The remaining construct questions from NBP were revised based on best practice measures for each area and to meet the goal of a brief screening assessment that can be self-administered by adolescents while waiting for a well-visit. Questions were added to assess for past alcohol in addition to current alcohol use. Participants were asked, "have you ***ever*** tried alcohol?" as opposed to "within the past six months." We included questions for current drinking behavior by asking how many times in the past three months a participant has had a drink with responses ranging from every day to never on a 5-point scale. Next, the preferred graduated frequency method was modified by creating categories of how many times certain qualities of alcohol have been consumed. The categories include 12 or more drinks of alcohol, 8-12, 5-7, 3-4 or 1-2 drinks of alcohol with a 5-point response scale ranging from "every day" to "never". Patients who report that they never tried alcohol are considered a never drinker. If patients answer "yes" to having tried alcohol, but have not had alcohol within the past three months, they are considered a former drinker. If they answered "yes" to drinking 1-4 drinks, but only once or twice in the past three months, they are considered an experimental drinker. If they answered that they drink 1-3 times per month or had 8 or more drinks even once in the

past three months, they are considered a current drinker. This method was able to categorize the multiple combinations of potential levels of alcohol use.

To assess for eating disorders, the EAT-26 was utilized. These questions were selected as being the most indicative of a suspected eating disorder using the DSM-5 criteria. Criteria include whether in the past year they have avoided eating when hungry, gone on eating binges and not being able to stop, vomited after eating, felt that others suggested there was a problem, and were preoccupied with being thinner (Garner et al. 1982). These items were also consistent with the ChEAT (Micali & House, 2011), the abbreviated version of the EAT-26 which has been validated for use with younger children, but not adolescents. The EAT-26 six-point scale was maintained ranging from never (0) to Always (5). Any score of 3 or higher indicates being at risk of an eating disorder with the exception of vomited after having eaten. If a patient answers "sometimes" to that question, they are considered as at risk for an eating disorder.

The final change to the original NBP assessment was to the mood rating. The NBP assessment included four questions with a three-point scale ranging from "never" to "often". This assessment was modeled after the Beck Depression Inventory (BDI) (Beck, 1988) to include three questions related to depressive symptoms with the same 4-point scale as the BDI ranging from 3 "always" to 0 "never". A patient who indicates that they attempted to hurt themselves will be screened as having suicidal ideation while thoughts of hurting themselves will be screened as having suicidal thoughts and elevated scores on the sadness question will screen positive for potential depression. The NBP question related to anxiety and the question related to irritability were retained, however, these items were revised to be consistent with the format and scale options for the depression

questions. A patient who had elevated scores on the worry question will be screened as possibly anxious. Selection of questions from the BDI may result in false positives, but as a screener, it was determined that false positives were preferable to missing identification of possible depressed adolescents. . Furthermore, the selected questions were consistent with the KADS (LeBlanc, 2002), which may have better reliability in a primary care setting despite the lack of evidence to date.

In constructing the new measure, we created or selected items or scales that were indicated by our literature review to be the most reliable and valid for use with adolescents in a primary care setting. Several were shortened to be administered within the time constraints of primary care. While the NBP-R measure was meant to be kept short and simple, content redundancies remained, and are desirable, because multiple items are the foundation for calculating internal consistency reliability. Adequate internal consistency can be calculated with 4-6 items. It is also preferable to start with more items because following validity testing some items may be cut from the final version of the measure. Following the pilot test of this new measure, Exploratory factor Analysis will be conducted for validation.

Physicians indicated that they were interested in having general feedback (a "yes" or "no" response) to be able to determine whether or not follow-up was required with respect to the eleven identified behavioral constructs. Physicians also indicated they would like additional information on the severity level of the behaviors that were indicated as a "yes" for follow-up. Physicians suggested that this should be accomplished in approximately ten minutes.

3.2 Intervention Design

The primary goal of this project was to build and pilot test a user-friendly electronic tool for physicians to be able to integrate behavioral health screening quickly and easily into their daily practice. A secondary goal was to design and pilot test a health promotion intervention to decrease alcohol and marijuana use among adolescents by encouraging them to increase healthy activities such as exercise and practicing stress management via a computer tailored feedback system. This section outlines the program intervention design including examining the health promotion approach, prevention methods, theoretical framework, and development of tailored feedback.

3.2.1 A Health Promotions Approach

The guiding principles of health promotion are to assist people in making health choices to ultimately lead a healthier lifestyle and thus prevent and help reduce the impacts of chronic illness . For this program intervention, the hypothesis was that promotion of increased exercise and stress management would thereby reduce risk-taking behaviors such as alcohol and marijuana use. A recent study provides evidence that health promotion can be used to decrease unhealthy behaviors by promoting health activities (Velicer at al., 2013). In that trial, researchers implemented a behavioral risk intervention with middle school students to prevent or reduce substance use. The control group was assigned to increase their healthy behaviors including exercise and physical activity and to more effectively manage stress in healthy ways. Unexpectedly results showed that that the control group participants, who had not had an intervention designed to prevent or reduce substance use, reported less substance use uptake or reduced substance use than the treatment group (Velicer et. al., 2013). The finding leads to the hypothesis that individuals will be less likely to participate in unhealthy behaviors if they

are focused on participating in healthy behaviors such as exercise and stress management. The rationale for intervening on exercise and stress management rather than just focusing on alcohol and marijuana prevention or reduction was bolster by the fact that the majority of adolescents in primary care are generally not participating in risk-taking activities. Thus a health promotion intervention that included health behaviors that almost all adolescents could participate in would be a product that would benefit the entire population of patients in pediatric primary care, not just those currently using or at high risk for substance use. Thus the intervention system developed here incorporated health promotion and risk prevention while also incorporating a risk reduction individual intervention approach using tailored feedback.

3.2.2 *Prevention methods*

Substance use was the primary construct area chosen for this intervention program based on the interests of the physicians in the participating pediatric practice and was consistent with national epidemiologic data showing that substance use among adolescents in the United States and in Rhode Island is a serious public health concern. A current analysis published by Swedsen and colleagues (Swedsen et al., 2012) for the Substance Abuse and Mental Health Services Administration reported that approximately 60% of all adolescents reported having used alcohol in their lifetime. That rate increased to 80% among adolescents between the ages of 17 and 18 years. Onset of alcohol use was reported between the ages of 13 to 14 years with 10% using alcohol regularly in that age group and 47% of 17 and 18 year olds using alcohol regularly. A small but significant proportion (5.2%) of all U.S. adolescents met DSM-IV criteria for alcohol abuse and 1.3% for alcohol abuse with dependence, and more of the older adolescents (17-18 years)

met criteria for alcohol abuse than the younger adolescents (13-14 year olds). Regarding drug use, approximately 10% of the younger adolescents aged 13-14 years, 28% of 15-16 year olds and 43% of 17-18 year olds reported illicit drug use. The rate of illicit drug abuse was higher (8.9%) than the rate of alcohol abuse (5.2%) and illicit drug abuse followed the same pattern as alcohol abuse with 3% of younger adolescents abusing illicit drugs as compared with 16.4% of older adolescents. The authors attributed the rise in illicit drug use to recent increases in marijuana use among adolescents and assert that that there may be a possible shifting of attitude among teens that is favorable towards marijuana smoking, which mirrors national trends on the legalization of marijuana growing and sales and normalization of marijuana use nationally. The first published study using a computerized system to reduce cannabis use among adolescents was underpowered but suggested a small impact on the reduction of marijuana use (Harris, 2012). Additional research with larger samples is needed assess the efficacy of computer-based interventions for marijuana use with adolescents. A second study did report a moderate effect size for the reduction of marijuana use, however that the effect was lost at three, six, and twelve-month follow-up assessment time points suggesting booster interventions may be necessary (Walton, 2013). The third and final study on marijuana use evaluated the feasibility, acceptability, and potential efficacy of a mobile device intervention to reduce adolescent marijuana use employing brief motivational interviewing. That intervention was reported to be feasible, well-accepted, and potentially efficacious for youth who use marijuana frequently (Shrier, 2013). Given the increase in marijuana use among teens and the national trend toward making marijuana even more

available, interventions that are efficacious and can be easily implemented such as those that use computer technology are clearly needed.

3.2.3 Intervention methods

Substance use interventions and treatments for adolescents have been implemented at different systems levels. Population level treatments for substance use have generally comprised of mass media and public policy campaigns. Studies of population interventions report the largest effect sizes when implementation of interventions are coordinated and have a consistent message. Media campaigns for substance use, however, have not been very successful. (Griffin, 2010). Schools have been a popular setting to test many of approaches to treatment and prevention of substance use among youth because they are an effective mechanism for reaching large numbers of children and adolescents (Griffin, 2010). Several of the earlier prevention methods at this level were not very effective either because they mainly consisted of lectured students on dangers of substance use or used fear tactics (Griffin, 2010). In addition, the earlier school-based interventions were not based on theory or on the risk factors that contribute to adolescent substance use (Griffin, 2010). The more recent literature provides evidence that school-based substance use interventions can be efficacious if based on theory and evidence-based therapies. Some of the more successful programs have utilized teaching social resistance skills and competence enhancement training based on the tenants of Cognitive Behavior Therapy (CBT) (Griffin, 2010).

A review of these treatment methods and interventions for substance use behavior change finds that the most efficacious individual treatments include motivational interviewing (MI) and CBT (Tripodi, 2010). CBT for substance abuse and behavior

change is characterized by a combination of therapeutic techniques such as operant learning strategies, cognitive and motivational components, skills building and other behavioral approaches. CBT interventions vary in the degree to which each of these components is used. (McHugh, 2010). Across intervention studies CBT emerges as highly efficacious in treating substance use. (McHugh, 2010). Motivational Interviewing (MI), which is frequently part of CBT interventions, is an approach that is especially useful for brief treatment episodes because it is delivered in an efficient and concise manner. MI works by targeting an individual's ambivalence toward behavior change and acts to motivate them through the stages of behaviors change (McHugh, 2010). MI, CBT and Brief Interventions are predominantly conducted at the individual level, although they have been delivered at the group level. Family-based prevention programs have been less emphasized for substance use treatment, but typically include parenting skills training and/or improving family functioning, communication, and family rules regarding substance abuse (Griffin, 2011).

Given the research on substance abuse treatment for adolescents, it appears that Motivational Interviewing and Cognitive Behavioral Therapy are the most effective and are most efficacious when delivered individually in a tailored manner.

3.2.4 Incorporating a Theoretical Model of Behavior Change

Theory informs the design and implementation of interventions. Meaning, once we assess for unhealthy behaviors, we can use theory on change to develop feedback to patients as a way to guide them through the change process. Choosing an empirically based theorie ensures a full, rational appraisal of the problem and possible solutions by guiding in the selection of appropriate variables and making sure that the all of the

necessary elements of a an intervention are in place to facilitate change. The Transtheoretical Model (TTM) was specifically developed to guide behavior change interventions and has since been utilized as the framework for assessment and intervention studies across multiple behaviors. TTM is a model based on the decision making of an individual for intentional change. It also fits well with the preferred, efficacious, evidence-based CBT and MI treatments. TTM identifies change as a process involving progress through a series of five stages; Precontemplation, Contemplation, Preparation, Action, and Maintenance (Prochaska & DiClemente, 1983) (previously described). Progress through the stages is primarily seen as related to two other TTM constructs, Decisional Balance and Self-efficacy. Decisional Balance reflects how a person weighs the pros and cons of changing their behavior (Janis & Mann, 1977). Self-efficacy reflects the level of confidence that an individual has in their ability to make behavioral changes and maintain those changes under challenging circumstances (Bandura, 1977 & 1982). TTM constructs for two substance use behaviors (i.e., alcohol and marijuana use) and two health behaviors (i.e., exercise and stress management) were assessed after the NBP-R assessment for mental and behavioral health issues. The answers were used to provide individual tailored feedback to patients. TTM also allows researchers to take a population health promotion approach to provide stage-tailored feedback to the entire population to reduce unhealthy behaviors and promote healthy behaviors (Velicer et. al., 2013). Therefore, using TTM, we were able to design an intervention to meet the needs of all participants, not just those ready for change. For example, we believe a TTM-guided health promotion of a targeted behavior, like exercise, could both help an individual increase their healthy behavior and possibly

reduce unhealthy behaviors (e.g., alcohol use). Specifically, program intervention utilized the newly developed assessment followed by TTM measures to then develop feedback to target an increase in exercise and stress management for the reduction of alcohol and marijuana use.

In this study, TTM was applied to create an intervention for behavior change using a tailored feedback system based on a person's answers to the newly designed assessment questions and their stage of behavior change. Stages of change and related decisional balance, self-efficacy, temptations scale or acquisition questions were assessed for the constructs that that were identified as the intervention constructs; the reduction of two risk-taking activities (alcohol and marijuana use) and the promotion of two healthy activities (exercise and stress management). Existing TTM measures of stage of change, decisional balance and self-efficacy were utilized for some constructs, others were adapted for use in an adolescent population. The process of adopting or adapting these measures is described below.

(A). Exercise was assessed using the Pro-Change (© 2004 Pro-Change Behavior Systems, Inc.) TTM measure were used to evaluate each patient's Stage of Change for exercise activity (Action criteria = 60 minutes or more of exercise at least 5 days/week), their value ratings of the pros (i.e. I would be in a better mood) and cons (i.e. it would take too much energy) for regular exercise as well as their confidence to exercise in challenging situations (i.e. when busy).

(B). Effective Stress Management was assessed using a staging algorithm (Mauriello et. al., 2006) consisting of five "yes" or "no" questions on current behavior and future intentions for effective stress management. The pros (i.e. I feel healthier when I manage

my stress) and cons (i.e. I don't see any benefits of managing my stress) of practicing stress management were assessed using a 5-point scale on the importance of each statement when deciding whether or not to practice stress management. Self-efficacy for stress management was measured using an adaptation of the adult confidence to practice stress management in certain situations (i.e. When I have problems in a relationship) (Pro-Change).

(C). Patients who reported drinking alcohol were assessed for intentions to reduce or stop drinking (Migneault et. al., 1997). The pros (e.g. I will have more fun if I drink alcohol) and cons (I will make better decisions without drinking) for alcohol use were assessed using a validated measure for middle school students (Babbin et. al, 2011). The decisional balance for stopping alcohol is a short inventory with three pros of alcohol use and three cons of alcohol use. For those who reported no use, their temptation to use was measured using the Temptations to Use Alcohol Scale that was also validated for use among middle school students (Harrington, et. al., 2010). It includes three subscales on social pressure, social anxiety and opportunity. An example of a social pressure questions would be "I am tempted to try alcohol when others my age are trying alcohol."

(D). Marijuana stage of change was assessed using four questions related to marijuana use in the past 30 days and the past 60 days as well as intention to reduce or stop using marijuana within the next 30 days or the next 60 days (Maisto et. al., 2011; Paiva et. al., 2005). Decisional balance items were assessed with the question "if I decided to not use marijuana…" followed by four pros (I might feel better about myself) of not using marijuana and four cons (I might have to find other ways to deal with my problems) to reducing or stopping marijuana use (Paiva et. al., 2005). For those who

reported never using marijuana, we assessed their temptation to use by asking "how tempted you would be to use marijuana if…" they were in certain situations such as being around others who use marijuana. The marijuana temptations scale was adapted from the Pro-Change System that was used to assess marijuana and "other drugs" among high school students (Paiva et. al., 2005)

3.2.5 Development of Tailored Feedback

TTM further supports that providing tailored feedback to individuals on variables such as stage, readiness, decisional balance, and confidence are strong predictors of change (Noar et al., 2007). Using TTM, researchers can tailor interventions for a particular behavior by stage. For example, if someone is in Precontemplation for quitting smoking, TTM tailoring would focus on helping them consider quitting and thus progress to Contemplation rather than pressing them to quit right away and produce resistance to change rather than progress. Within each stage, TTM suggests processes of change that will help increase the awareness of pros by either increasing healthy behaviors or decreasing unhealthy behaviors (i.e. increasing the value of the pros of exercise or the pros of quitting smoking) and decreasing the importance of the cons (i.e. the cons of exercising or the cons of continuing to smoke). Also within each stage TTM processes of change are tailored to stage in order to help build a person's confidence (i.e. their confidence in their ability to stop smoking in challenging circumstances). Tailoring interventions to stage of change reduces participant resistance to change and increases the likelihood of progress to Action.

In developing tailored feedback for this intervention, normalized statistical data was used in combination with assessment results and stages of change to develop tailored

feedback. Normative data was provided first based on a patient's demographics (grade level), specific answers to assessment questions, followed by TTM measures of behavior change. Responses from stage of change questions for alcohol use, marijuana use, exercise and stress management were used in feedback to patients. The tailored feedback provided a positive message highlighting their current health behavior(s) rather than critical feedback highlighting their negative behavior(s). All participants also received feedback encouraging them to increase healthy behaviors such as exercising and stress management activities (e.g., exercise, listening to music). The benefits of increasing healthy behaviors will be described including improved mood, attention and physical ability.

3.2.6 Normative Data

Normative data can be used to demonstrate to patients where they are to others in the general population. This can be particularly useful for teens not currently using alcohol because teens tend to think that more people their age are actually using alcohol than is accurate. In this study, adolescent patients' answers were matched to the normative data (Table 1) from Rhode Island. Data are presented according to grade level, gender and whether or not they ever tried alcohol and marijuana, are current users of alcohol or marijuana and whether they currently participate in 60 minutes of exercise at least once per week up to seven days per week. At the time of intervention development, these data were the most current data available in Rhode Island and were accessed using the Youth Risk Behavioral Surveillance on the cdc.gov website (YRBS, 2011). Table one provides normative data for grades 9-12 who are typically between the ages of 13-18 years. Each patient will report their grade level and gender and were matched to the data

within the cells of table one. For example, a ninth grade girl who has never tried alcohol will receive the feedback "half of the girls your age have also never tried alcohol. Congratulations on making a healthy choice like half of all the girls in 9th grade in Rhode Island. Keep making healthy choices!" A separate yet similar normative table will be created for the older adolescents between the ages of 18-21 years. All participants received four feedback statements; one for each stage of change for alcohol, marijuana, exercise and stress management. The feedback statements can be found in Appendix E. Feedback was also based on a patient's stage of change. This was the beginning stages of intervention feedback development to include stage feedback. Future versions may include the decisional balance and self-efficacy constructs. Furthermore, after cognitive testing the original feedback proposal was shortened to limit word count for participant understanding and for brevity of administration. This process is described in greater detail in the chapter on results.

Table 1. Normative substance use and exercise data for 9-12th graders in Rhode Island

	Grade	*Males (%)*	*Females (%)*	*Total (%)*
Never Tried Alcohol	9th	*54*	*50*	*52*
	10th	*40*	*38*	*39*
	11th	*38*	*29*	*34*
	12th	*27*	*25*	*26*
	Total	*40*	*36*	*38*
Never Tried Marijuana	*9th*	*68*	*76*	*72*
	10th	*56*	*67*	*62*
	11th	*53*	*61*	*57*
	12th	*45*	*51*	*48*
	Total	*56*	*64*	*60*
Current Alcohol	*9th*	*22*	*24*	*23*
	10th	*30*	*33*	*32*
	11th	*37*	*41*	*39*
	12th	*45*	*45*	*45*
	Total	*33*	*35*	*34*
Current Marijuana	*9th*	*24*	*16*	*20*
	10th	*30*	*21*	*26*
	11th	*30*	*23*	*26*
	12th	*37*	*31*	*34*
	Total	*30*	*23*	*26*
Current Exercise, 1-7 days	*9th*	*66*	*80*	*73*
	10th	*65*	*80*	*73*
	11th	*65*	*80*	*73*
	12th	*62*	*86*	*75*
	Total	*65*	*82*	*73*

3.2.7 Original Feedback Design

After cognitive testing was initiated, with a subset of the sample to ensure that they are able to understand the instructions and questions, the feedback was presented in a format that was easy to read, understand and had a short administration time. After patients answered questions on mood, exercise, sleep, caffeine use, alcohol use, marijuana use, exercise and stress management as well as the follow-up questions on stage, decisional balance and self-efficacy for alcohol use, marijuana use, exercise and stress management, participants received immediate stage-tailored feedback based on

their responses. The tailored feedback provided a positive message highlighting their current health behavior(s) rather than critical feedback highlighting their negative behavior(s). For example, participants who did not report using alcohol or marijuana received feedback that read "You are just like most kids (percentage was included based on demographic information) your age that do not use marijuana/drink alcohol." Alternatively, if participants reported they were currently using alcohol or marijuana, the feedback was tailored positively on their readiness to change and their perceived confidence to change; for example, a person in the Precontemplation stage with a perceived low confidence to change received a message that read "Congratulations on recognizing the benefits of reducing your alcohol use. Did you know that increasing the amount that you exercise may help to increase your motivation to cut down?" Or, a person in the stage of preparation with a high level of confidence to make changes in their behavior received the feedback "congratulations on your thoughts of improving your health and in your confidence to take steps to make those changes." All participants also received feedback encouraging them to increase healthy behaviors to exercising and practice stress management techniques (e.g., exercise, listening to music). The benefits of increasing healthy behaviors were also described including improved mood, attention and physical ability. A complete transcript of stage-based feedback can be found in appendix E.

Chapter 4.

Feasibility Test of MASCOT System: Gathering Evidence with Data Collection

4.1 The MASCOT System

Once the focus group discussions were completed, a needs assessment conducted, a multi-behavior measure constructed, feedback algorithm for tailored feedback written, it was all loaded into the tablet computer to create the competed program. It was named MASCOT (Multiple Assessment Symptom Checklist Of Teens) System. A programmer, Michelle Loxley, with expertise in Microsoft Access was consulted to consider software platform and hardware considerations in October, 2012 and was later hired to program the MASCOT system. The programmer had over ten years of experience as a software developer, research database manager, and program and database administrator to the project. She had experience designing very similar intervention systems for research purposes using the same software platform and she had experience creating a tailored feedback loop. During the course of program development, six in-person meetings took place with Ms. Loxley to plan the design the system and to discuss subsequent updates of the system. In addition, there was frequent, sometimes daily email communication, and editing that occurred throughout the duration of the project. Ms. Loxley was available for immediate consulting from the physician's office during testing of the system to assist with problem-solving error messages during the initial phases of the pilot test of the MASCOT program system.

Microsoft Access was chosen as the program platform based on the requirements of the pediatrician's information technology security features. The security system

required a Windows based operating system and Access allowed the programmer to create an assessment and feedback program system. Microsoft Access was also an economical choice as it is widely available as a component program of Microsoft Office. Since a Microsoft Windows-based product was required the Surface Pro was selected as the hardware device to host the program system. The Surface Pro is similar to the size and functionality of an Apple IPad with a high resolution touch screen, was considered as user-friendly and appealing to the adolescent population to be studied. In June, 2013, Ms. Loxley provided an initial copy of a potential computerized assessment. Funding was subsequently secured with a grant from the University of Rhode Island (Enhancement to Graduate Research Award; EGRA) to fully support programming of the MASCOT feedback intervention loop. A prototype of the full MASCOT program was finalized in April, 2014. The system was iteratively tested by the stakeholders and revisions were made both in content, programming logic, look and feel (e.g., readability, font size and style), and interface as a touchscreen application on the Surface Pro. For example, suggestions were made to increase the font size on assent form even if that meant the form could not be displayed on one screen. In fact, it was suggested that the font size be larger for all directions and that key instruction for Decisional Balance items be highlighted or bolded. Pros and cons items were reordered so that two items about "energy" were not next to each other. A header was added to the feedback screen so that "Health MASCOT Feedback" was prominently on the top of the screen. The length of the feedback narrative was reduced so that the benefits of exercise were listed rather than presented in paragraph form. Similar changes to improve clarity, readability and easy access on the hardware were implemented across the other content areas.

4.2 IRB Approval

This project received IRB approval on October 26, 2013 after a full board review. It was approved following an annual review in 2014, and is currently approved through June 17, 2015.

4.3 Sample

Participants were patients at Narragansett Bay Pediatrics, Wickford, R.I. All patients thirteen to twenty-one years old meeting with their doctor for a well care visit were eligible to participate. Patients who were unable to read, unable to read English, or had a severe cognitive impairment were excluded. Staff were made aware of the purpose of the study, inclusion and exclusion criteria and asked to recruit eligible patients. Dr. Corcoran personally recruited and obtained consent from all patients. Parents were asked to sign informed consent for their child to participate in an intervention that promotes healthy behaviors. Parents of patients and/or adult patients were informed of the potential risks and benefits of participating. Parents were informed that they, or their child, could refuse to participate at any time before or during the study. All procedures were approved by the URI IRB and by participating physicians at Narragansett Bay Pediatrics prior to any patient enrollment. Every effort was made to recruit equal numbers of males and females as well as to recruit racial and ethnic minorities for this study. The greatest risk to participants in any study is the potential breach of confidential information. To protect confidentiality, each participant was assigned a unique ID number and no identifying information was collected or maintained by the MASCOT system with the data during the study. Participants' consent forms are kept in a separate locked filing cabinet in the Physician's office separate and apart from the de-identified data. We obtained informed

consent from 18 patients for cognitive testing and 37 patients for pilot test MASCOT system. Dr. Corcoran also provided consent to participate in assessing the system.

4.4 Consenting methods

Upon arrival to the physician's office, parents and patients were asked to participate by Dr. Corcoran. Parents of minor children were asked whether or not they would like their child to participate in research. If a parent agreed, the minor children were also asked to provide their assent to participate. Both parent and child needed to provide permission prior to enrolling in the study. Adult patients aged 18 years or older were asked to consent for themselves. There were separate consent forms for the cognitive testing procedures and for the pilot test of the MASCOT system; however, the consenting procedures were the same. The physician also signed consent to participate in the assessment of the system. For the cognitive testing phase of the system parents were asked whether their child would be interested in testing a program on a tablet computer that was designed to ask teens some questions about their health behaviors including exercise, stress management, eating habits, substance use, mood, and sleep habits to evaluate and give their feedback on the user-friendliness of the program. Parents were assured that their child was free to stop answering questions at any time they were free to refuse to allow their child to participate, and the child could also refuse to participate. Furthermore, parents were assured that refusing to participate would not change the way the doctor will treat your child. However, the doctor might still ask similar questions, as those asked in the computer program, as part of their normal exam.

The pilot test consent was similar except that parents or patients were informed that patients would be asked to answer questions about their health behaviors on a tablet

computer and would then be provided some feedback about their health behaviors that were tailored to them. The consent stated that the physician may or may not talk with them about the results. Assent forms for minor patients provided limits to confidentiality such that if the doctor thought safety was at risk, she may find it necessary to talk with their parent(s) about specific answers to questions in the MASCOT system. Once a parent provided consent, children provided assent or an adult patient signed the consent form, the patient was handed the tablet computer. The doctor stored the signed consent form in a locked file cabinet that was kept separate from the Surface Pro tablet.

4.5 Cognitive testing

Cognitive testing was completed on (N=18) patients in two phases over the course of four months from May, 2014 through September, 2014. Cognitive testing was initiated with adolescent patients to determine usability of a prototype of the MASCOT system in July, 2014. Physicians also evaluated usability of procedures for integrating the system into the workflow of their practice. The cognitive assessments of the MASCOT system were conducted with adolescents to time the administration, ensure that instruction sets and questions were understood, evaluate any concerns with the user interface, and test for any potential errors in the system. Adolescents were also asked to give input on the look, feel, and tone of the program.

The period of cognitive testing also acted as a period of time to train the physician and her staff on administration procedures and to assist them in managing the implementation of the system into their practice with the least amount of interruption in their usual work flow. The physician was given a prototype instruction sheet to help assist in implementation. The instruction sheet, which they followed in a step-by-step

fashion. Instructions contained the system password to gain access to the computer, instructions on accessing the MASCOT system within the Microsoft Access program from the desktop. The instructions walked the physician through the steps of developing a computer generated participant ID next in the sequence. Once the physician selected the ID number, they were instructed to hand the tablet to the patient who was then asked to provide their assent electronically. When the patient completed the assessment questions, the physician was instructed to select a view of the participant's feedback. She then had to enlarge the screen, and to select "print" if she wanted to keep a copy for the patient's medical record. Once the electronic feedback had been read by the participant, the physician then was asked to select "close print preview," from the Microsoft Access menu, but had to take care to not close the program, which was easy to do if you select the wrong "X" at the top right of the screen. If the program was closed by accident, there was no way to re-enter the system without generating a new ID number. Once the feedback was closed, the physician was able to view the physician feedback menu. She needed to enter a four-digit password to obtain the results. The physician was then asked to select the patient acceptability survey from the main menu, and hand the tablet back to the patient to complete the patient assessment survey. Patients were instructed after completing the acceptability questions, to hand the tablet back to the physician who would then complete the physician acceptability survey.

Cognitive testing was completed with a first round of N=10 patients. Most of the cognitive testing patients were of high school age, who reported completing an average of 9.4 years of education There were several elements of the MASCOT system that were identified for improved efficiency. Difficulty with printing the summary page for the

physician were found and resolved. Patients reported confusion as to what qualified as a caffeinated beverages and requested examples be added, such as “Coca Cola” or “coffee” and “iced tea” be added to clarify. An error message occurred for some participants while in exercise module (see appendix) when they selected the “no I don’t plan to start exercising” choice that ended the session. The font of the instructions text was still felt by some participants to be too small. The instructions for the physical activity section was at too high a reading level, specifically “accumulated” was deemed a complex word and needed simplification. Examples of additional specific questions that patients had included; “when you ask about vomit, does that mean when sick?” In fact, it was referring to bulimia and needed clarification. “Does milk have caffeine?” which prompted the examples of caffeinated beverages. “Do wake-up times mean during the school year or summer?”

The average time it took a participant to move through the system from assent to feedback was approximately eight minutes. This time did not account for consenting procedures, participant assessment of the system, physician review of the results, or physician feedback. Other issues identified during cognitive testing included automatic software updates popping up onto the screen. Patients were asked what grade they were in because that is how the data were presented for the normative feedback, however in the first draft of the intervention, only grades 9-12 were included, but the cognitive testing revealed that grades 6-8 as well as college-level should also be included. Parts of the follow-up questions for Physician and patients were truncated by screen limitations and were edited to address to fit the presentation space. The physician also indicated that she would like to see the actual number of alcohol beverages reported and amount of

marijuana use reported by patients. At the end of phase one cognitive testing, data back-up procedures were discussed with the physician and relevant office staff. They included backing-up data to a cloud server such as Dropbox or backing-up data to a thumb drive. Both options were time consuming for the office manager. Another concern was asking office staff to remember to charge the tablet in-between patients and overnight.

A second round of cognitive testing was completed with N=8 patients. An effort was made to recruit younger middle school patients since the majority of patients completing the first half of cognitive testing were high school aged to ensure that all patients would be able to use and understand the system. During this round of testing, patients were asked detailed questions as they moved through the intervention system. They were asked pointedly how they understood each question, each set of instructions and each answer choice. Since the first round of testing resulted in an older sample of adolescent, a younger sample was selected to ensure they comprehend the system as much as older patients. During this period, the office manager and physician practiced using the system on their own. Suggestions from the second round of testing included turning off access to computer menus or disable the rest of the computer while in the MASCOT Program. Unfortunately, due to the design of the computer and Microsoft Access program disabling menu access was not possible. Therefore, patients were able to see the menu at the top of the screen. However, if they were to exit the MASCOT system, they were not able to access any other programs. In addition, internet access was disabled and all collected data were de-identified on the tablet. So a patient exiting from the MASCOT system on the computer posed no risk to patient confidentiality.

After reading their tailored feedback, the patient was prompted to hand the tablet to the pediatrician. The physician entered a pass code to review a summary report on the health and risk behaviors for that patient as well as a summary of the patient's stages of change for increasing exercise and stress management and decreasing alcohol and marijuana use. The physician then provided their usual standard of treatment for the well-visit. At the conclusion of the visit, the physician handed the tablet back to the patient to complete a brief post-test. The post-test included measures of Stage of Change, Decisional Balance and Self-efficacy for the four target behaviors to assess for possible short-term change of these constructs. Feedback was not given during the post-test assessment; however, patients received a print out of their tailored feedback before they left the office. Impact of the MASCOT system was assessed by asking patients what they liked most about the study, whether they thought it was user-friendly, whether the information provided made them think about changing their health or substance use behaviors, or if the information provided was helpful to them and the questions prompted them to talk to their doctor about something they otherwise would not have talked about. Finally, the physician was prompted to complete a brief (yes/no/N/A) checklist with questions that were developed during the key informant interviews. Questions included whether or not they intervened on any of the patient's reported behaviors, whether the intervention include the patient's parents, and whether any follow-up was planned for the patient. Lastly, a series of questions were asked of the patients and physicians with four response options ranging from "Strongly Disagree" to "Strongly Agree" was used to gauge acceptability of the system. Patients were asked whether the system was perceived as beneficial overall, whether the MASCOT system was easy to use, and whether the

questions and feedback were easy to understand. Physicians were asked similar questions with response options ranging from “Strongly Disagree” to “Strongly Agree” to gauge usefulness of the system and feasibility of integrating the system into practice. Physicians were also asked whether they would recommend the system to others. In addition, two open-ended questions were asked to gain participant and physician feedback on what they liked the most and least about the MASCOT system.

Physicians and staff were surveyed more extensively using qualitative methods on the usefulness and practicality of the assessment and feedback tool after the first half of cognitive testing was complete. Physicians answered questions on the impact this intervention had on their standard treatment practice. Questions assessed whether the feedback was helpful to increase conversations between patient and doctor, whether the information provided was useful for determining appropriate treatment methods, if there were elements of the system that needed to be changed or if there was anything that was not working correctly or consistently.

After all cognitive testing was complete; feedback from the cognitive testing phase was used to improve the look, feel, flow, content, and usability of the system. For example, during the cognitive testing phase, the physician requested additional information be displayed on the physician report regarding the quantity of patients’ alcohol and marijuana use. The report initially provided physicians with a simple yes/no finding for problem alcohol and/or marijuana use in the initial system design. During cognitive testing, Cognitive testing also helped determine the process flow meaning that the nurse needed to adjust the number of patients brought back to the exam room so that the doctor could stagger when to introduce the study and consenting process versus the

intervention. Essentially, she was going back and forth between two exams rooms as patients moved through various stages of the intervention from consenting to follow-up and assessment. After these adjustments were made, the MASCOT system was readied for Pilot testing.

Chapter 5.

Findings

5.1 Pilot Test Sample characteristics

The MASCOT system was piloted with n=37 patients. Of these patients, there are missing and/or incomplete data for n=12 patients for whom the system terminated early due to technical difficulties. As demographic information was collected last by the MASCOT system, no descriptive demographic information is available for these twelve patients. No patients asked to stop participating and only one patient who was recruited by the physician refused to participate. Of the twenty-five participants with complete data, (80%) were female, three (12%) were in grades 6-8, twelve (48%) were high school students, eight (32%) were college students, and two (8%) were high school graduates not attending college. Behavioral health characteristics for these patients are presented in Table 5.1.

Table 5.1 Characteristics of Behavior

	N=28 (%)
Alcohol use - ever	16 (57.1)
12 + drinks on one occasion in past 3 months	6 (40)
8-12 drinks on one occasion in past 3 months	8 (53.3)
5-7 drinks on one occasion in past 3 months	11 (73.3)
3-4 drinks on one occasion in past 3 months	11 (73.3)
1-2 drinks on one occasion in past 3 months	13 (86.6)
Cigarettes per day – none	20 (71.4)
1-15 cigarettes per day	2 (7.1)
16-24 cigarettes per day	3 (10.7)
More than 25 cigarettes per day	3 (10.7)
Caffeinated beverage use	
0 cups caffeinated drinks per day	10 (35.7)
1-2 cups caffeinated drinks per day	12 (42.9)
3-5 cups caffeinated drinks per day	1 (3.6)
5-7 cups caffeinated drinks per day	3 (10.7)
More than 8 cups caffeinated drinks per day	2 (7.1)
Marijuana use - ever	13 (46.4)
0 times past 30 days	4 (30.8)
1-2 times past 30 days	2 (15.4)
3-9 times past 30 days	4 (30.8)
10-19 times past 30 days	3 (23.1)
High Stress	
Yes	3 (10.7)
No	25 (89.3)
Average sleep (hours) per night	28 (7.6)
60 Minutes or more of exercise – 0 days	5 (17.9)
1-4 days	14 (50.0)
5-7 days	9 (32.1)
Disordered eating - yes	3 (8.1)

The MASCOT program was pilot tested in a large pediatric practice with seven licensed physicians. For this project, one physician (N=1) pilot tested the feasibility of the MASCOT system being integrated into the daily flow of this practice. The system was rated qualitatively for likability and integration into office flow for time and procedures. The pediatrician rated whether the MASCOT system worked and/or she perceived it could be integrated in the future for all patients. After attempting to test the program on 37 patients, her overall opinion was that the MASCOT system was a useful, worthwhile and important tool. However, the system was difficult to use at some points. For example, a patient would finish answering questions fairly easily, but it was difficult to retrieve the feedback from the system. In addition, the physician was instructed to close out of the feedback system by selecting the "X" at the top right of the screen. However, it was very easy to accidentally select the "X" to close the entire system, especially if doing it quickly. If that circumstance, there was no method to open the same patient's file, and their session was therefore terminated early and unintentionally. Since data were not collected on how many patients read the patient feedback, it is difficult to report how many actually read the feedback. However, since the problem was in closing the patient feedback, it is more likely that all patients who completed assessment data were also able to read the patient feedback and were not able to enter back into the system to compete a final acceptability assessment of the system. The entire set of procedures was also more time consuming than was initially anticipated, particularly the informed consent process, and was therefore difficult to fit into the flow of office practice. As a result, Dr. Corcoran was unable to use the MASCOT system with every adolescent scheduled for a well-visit on a given day, but rather chose to use the system

with a patient when the schedule could allow for the extra time necessary to complete the study procedures. Ultimately, the Dr. Corcoran reported that this program would be perfect if the patient was able to complete the assessment before their visit and it could then be emailed or transferred to office to upload into their medical record. Dr. Corcoran's office is installing a new software platform using a new electronic record system called Child Health and Developmental Interactive system CHADIS for pediatricians. The program was designed through an initiative of the Total Child Health, Inc. A Center whose mission is to conduct research and further develop computerized methods of assisting primary care clinicians in the detection, treatment and prevention of mental, behavioral and developmental problems in children, as well as promoting positive development in all children. While, it is unclear how much screening would be available via this system, or what evidence-based measures are used, it is promising that there could be future collaboration between an updated version of the MASCOT system and the CHADIS system. In addition to some software errors that occurred in the MASCOT program, the necessary research procedures were considered a challenge to the ability to efficiently evaluate the system. Dr. Corcoran and office staff reported that consenting procedures could take just as long as the time necessary for a patient to complete the assessment and feedback section of the MASCOT program and even more time if the patient's parent had questions. Despite program errors that caused to the system to crash after giving the feedback for 12 of the patients, when it did work, the physician found the physician feedback both easy to read and helpful. Dr. Corcoran was only able to complete the physician assessment of the system six times. However, she reported that she found the information provided on the reported behaviors helpful for

patient treatment 100% of the time. She also noted that the physician feedback report was easy to read and understand 100% of the time.

5.3 Patient assessment of system

Table 5.2 presents patients acceptability ratings of the MASCOT Program. Half of all patients reported that the MASCOT program prompted them to talk to the doctor about something that would not have otherwise n=9 (50%). The majority of patients reported that the program was helpful, easy to use, and may have prompted them to talk to the doctor about something they may not have otherwise. Two out of the 18 participants made additional comments. One person wrote I LOVE IT! The other person suggested that the tablet was hard to use and that perhaps an IPad would have been more user friendly.

Table 5.2 Patient Acceptability Ratings of the MASCOT Program

	Strongly Disagree % (n)	Disagree % (n)	Agree % (n)	Strongly agree % (n)
Overall, the tablet was helpful	(5.6) 1	(16.7) 3	(55.6) 10	(22.23) 4
The questions were easy to understand	(5.6) 1	(11.1) 2	(66.7) 12	(16.7) 3
The feedback was easy to understand	(5.6) 1	0	(72.2) 13	(22.2) 4
The feedback provided was helpful	(5.6) 1	(5.6) 1	(72.2) 13	(16.7) 3
Prompted me to talk to the doctor about something I would not have otherwise	(11.1) 2	(38.9) 7	(33.3) 6	(16.7) 3

5.4 Short Term Intervention

The physician reported that the information provided about behaviors on the physician feedback report was useful 100% of the time. Table 5.3 reports whether or not the physician provided psychoeducation on any positively screened health behaviors. Table 5.4 shows whether or not parents were involved in that treatment.

Table 5.3 Physician provided psychoeducation on the following health behaviors

	Yes N (%)	**No N (%)**
Eating Disorder	2 (28.6)	5 (71.4)
Smoking	2 (28.6)	5 (71.4)
Caffeine Use	1 (14.3)	6 (85.7)
Sleep Hygiene	2 (28.6)	5 (71.4)
Stress management	0	7 (100)
Alcohol Use	3 (42.9)	4 (57.1)

Table 5.4 Parents were included in psychoeducation treatment

	Yes N (%)	**No N (%)**
Eating Disorder	0	7 (100)
Smoking	0	7 (100)
Caffeine Use	0	7 (100)
Sleep Hygiene	2 (33.3)	5(66.7)
Stress management	0	7(100)
Alcohol Use	2 (40)	5 (60)

5.5 Stage of change

Only those who reported using alcohol or marijuana and reported not participating in exercise or stress management were asked follow-up post-stage of change questions. Therefore, there were (n=9) matched pre-post stage of change data for alcohol (n=8) for Marijuana use, (n=6) for exercise 5 times per day, and (n=18) for stress management. Data were analyzed for significant differences using the Chi-square test of significance. Table 6.5 represents pre and post-test stage of change for those reporting any alcohol use.

Table 5.6 represents pre and post-test stage of change for those reporting any marijuana use. Table 5.7 represents pre and post-test stage of change for 60 minutes of exercise 5 days/week. Table 5.8 represents pre and post-test stage of change for practicing stress management techniques. No significant differences were found.

Table 5.5 Pre and post-test stage of change for those reporting any alcohol use

Stage of Change	**N= 9**	**N= 9**	**Sig**
	Pre-test	Post-test	
	N (%)	N (%)	
Precontemplation	5 (55.6)	3 (33.3)	NS
Contemplation	1 (11.1)	2 (22.2)	NS
Preparation	1 (11.1)	2 (22.2)	NS
Action	0	0	NS
Maintenance	2 (22.2)	2 (22.2)	NS

NS = Not Significant

Table 5.6 Pre and post-test stage of change for those reporting any marijuana use

Stage of Change	**N= 8**	**N= 8**	**Sig**
	Pre-test	Post-test	
	N (%)	N (%)	
Precontemplation	2 (25.0)	2 (25.0)	NS
Contemplation	1 (12.5)	3 (37.5)	NS
Preparation	0	0	NS
Action	1 (12.5)	0	NS
Maintenance	4 (50.0)	3 (37.5)	NS

NS = Not Significant

Table 5.7 Pre and post-test stage of change for 60 minutes of exercise 5 days/week

Stage of Change	**N= 6**	**N= 6**	**Sig**
	Pre-test	Post-test	
	N (%)	N (%)	
Precontemplation	1 (16.7)	2 (33.3)	NS
Contemplation within next 30 days	3 (50.0)	1 (16.7)	NS
Contemplation within next 6 months	2 (33.3)	3 (50.0)	NS

NS = Not Significant

Table 5.8 Pre and post-test stage of change for practicing stress management techniques

Stage of Change	**N= 18**	**N= 18**	**Sig**
	Pre-test	Post-test	
	N (%)	N (%)	
Precontemplation	2 (11.1)	2 (11.1)	NS
Contemplation	3 (16.7)	10 (11.1)	NS
Preparation	1 (5.6)	0	NS
Action	3 (16.7)	6 (33.3)	NS
Maintenance	9 (50.0)	0	NS

NS = Not Significant

C. Lessons Learned

There is a significant need for improved behavioral and mental health assessment and intervention in pediatric primary care. This project was a significant undertaking and is similar in scope to what is typically completed for an intervention development and feasibility award from NIH (i.e., two year timeline for $275K). This project sought to combine an assessment of behavioral and mental health problems into a tablet-based computer tailored intervention using the TTM as a theoretical base. The MASCOT program developed and piloted for this project provided stage tailored feedback on eight behavior health areas. In order to develop this program, a logic flow for the system needed to be created. Then, the content was written for the system followed by the oversight of the programming, and concluding with the iterative testing of the initial programming. Once a beta was ready, feedback was collected on the system from collaborators, a series of two cognitive interviews were completed. System improvements were made while working with office staff and the physician to integrate procedures into their workflow. Once the system seemed ready for pilot testing, the formal feasibility test of the MASCOT program was initiated. This program required an understanding of the key health behaviors, integration of theory, and considerations for programming and software utilization. It also involved the iterative process of system development, considering the needs of all stakeholders, and culminating in a pilot test and evaluation of the completed MASCOT program.

Behavioral health integration is an important concept for the future of medicine. The Surgeon General's Report in 1999 stated that there were "lots of ideas, models and enthusiasm [for behavioral health integration] but –so far – not a lot of success" (Albery

et. al, 2003). Since then, integrated medicine has received much more attention, but still leaves a lot to be desired at both the systems level and service level. Service level integration is the process of merging of primary care and behavioral health care services to meet the individual's needs (SAMHSA.gov). At a minimum, service level integration means providing integrated screening for risk behaviors and integrated treatment or coordinated referral treatment. Even operating at the simplest integration service level, physicians and systems face multiple barriers (Klimas, 2012). The greatest barrier to implementing behavioral health integration in primary care has been lack of time (Van Hook et. al, 2007). Modern research has the benefit of utilizing technology as a tool to be used in primary care to overcome this barrier.

The primary aim of this study was to test and evaluate the feasibility of integrating a computerized assessment of multiple behaviors with a computer driven tailored feedback for the promotion of health behaviors and for the reduction of alcohol and marijuana use a pediatric primary care setting. This project was novel and innovative given that few studies of this type have been conducted with adolescents in primary care despite advances in technology. Only two other similar studies were found in the literature. Participants in one of the other studies completed a computerized screening assessment, immediately viewed the screening results including information on the harms of substance use, but physicians were required to deliver the MI treatment (Harris, 2012). Results showed that computerized screening, combined with patient feedback and physician delivered MI treatment decreased alcohol and marijuana use at follow-up as compared with standard of care treatment (Harris, 2012). The second study involved a computerized intervention designed to examining the efficacy of brief interventions

delivered by a computer or therapist on adolescent marijuana smoking behavior (Walton, 2013). Adolescents in that study completed a survey on marijuana use and were then randomized to a computerized treatment or a provider delivered treatment. Among adolescent cannabis users, computerized treatment decreased cannabis use as much as provider delivered treatment in short-term follow-up (Walton, 2013).

The current project was initiated at the same time as the Walton et al., 2013 study and the aims were similar, however, this study was a pilot study with a very small budget and not a randomized control trial. Hypotheses for this project were based on previous studies demonstrating the utility of computer assisted assessments, the Transtheoretical model of behavior change and the guiding principles of health promotion. This project had many components and the results were mostly favorable. Significant process work led to the development of the interactive stage based computer program for adolescents that both assessed for multiple behaviors and provided tailored electronic feedback was successful. The physician who administered the intervention found the report information on current behaviors was both useful and important. The patients found the program user-friendly and the feedback on their current behaviors and the benefits of increasing exercise and stress management techniques useful and helpful. Additionally, both patients and doctor felt that the program increased important conversations that they might not otherwise have had on important mental health and behavioral health risks. The physician noted that the program was not as user friendly as she would have liked and that the necessary research procedures (e.g., informed consent process) slowed down the pace of her practice. A future generation MASCOT system, if implemented for clinical practice and not primarily research, could be more easily integrated into practice flow.

The patients, however, reported that the system was user friendly and that the program was easy to navigate. The biggest effect the system may have had on patients is that it prompted nearly half of all patients to talk with the doctor about a mental or behavioral health risk they would not have otherwise discussed had they not used the MASCOT system. Importantly, the MASCOT system engaged both patients and physicians in potentially important health conversations.

One of the main issues that the physician reported slowing down her practice was the research protocol. It took as much time (approximately ten minutes) to complete the consenting process, prior to the intervention, as it did to complete the intervention itself. After the intervention, additional time was spent on the research protocol to collect physician follow-up evaluation of the reported behaviors as well as patient assessment of the patient feedback. These additions to the length of the patient visits presented such a burden for the physician that it led to these steps being omitted for some patients, which led to only a small sample of patients with complete post assessment data. The intervention itself took an average of eight minutes to complete. Adding time for consenting and evaluating the program, the entire process took 25 minutes. This suggests that in a pediatric primary care setting without the additional elements of a research protocol, the intervention itself could be feasibly delivered.

A second issue that the physician reported impeded her practice flow was the program was not sufficiently user friendly. Microsoft Access features the familiar, generic, Windows look and feel, and while forms were customized for patients ease of entering information, Microsoft Access is ultimately an information management tool and is not very visually appealing. Access also requires some level of technological

savviness to generate reports and queries. When completing the MASCOT program, the patients appeared to have had an easier and more pleasant experience using the program as they were presented with the more user-friendly custom designed data entry pages. Patients were not required to navigate through the system, as was required of the physician in order to generate feedback reports. Teens are also more likely to be technologically savvy. Since the physician may not have been well versed in using Access prior to this study, it is understandable why it may have been cumbersome to navigate through the reports quickly. More physicians training and/or a more user-friendly program would be advantageous in the future for ease of use and physician buy-in. The user interface for the physician has to be user friendly as it is for the patients in order for it to be successful in an integrated system.

Since physician administration the intervention was slowed down by the research protocol and by software glitches, the total sample size recruited for the MASCOT program was smaller than anticipated. In addition, there were missing data from patients who were not administered the follow-up assessment when the physician either did not have the time to administer these sections of the MASCOT program or was unable, due to system complexity, to navigate through the queries to generate the appropriate questions. The problem with early termination of the system also may have also led to an underreporting treatment issued by the physician since those questions were asked as part of the physician follow-up evaluation questionnaire.

Perhaps one of the most striking findings was that a significant percentage of patients assessed reported drinking alcohol. More than half of all patients (n= 16) have had at least one drink of alcohol ever in their life, 40% of those who reported every

drinking (n=6) reported drinking twelve drinks or more in the past three months, and almost 90% of those who reported ever drinking alcohol (n=13) reported having 1-2 drinks in the last three months. One person reported drinking daily. Similarly, nearly half of all patients reported having smoked marijuana ever (n=13). 23% of patients who reported ever using marijuana n=3 reported having smoked 10-19 times in the past 30 days. These findings are consistent with the literature and validate the need for intervention. It further highlights that intervention in primary care offers an opportune time and place to intervene with substance use. Additionally, though there were no statistical differences noted in stage of change among those who reported using alcohol or marijuana, patients did appear to move from Precontemplation to Contemplation and preparation for the reduction of alcohol use indicating that an intervention of this type could be beneficial. However, there was one difficult to interpret finding related to alcohol and marijuana use. It appears that some patients may have moved out of maintenance to other earlier stages of change. One hypothesis that explains this result is that since these patients answered in the pre-test that they had already taken steps to reduce use, they indicated on the post-test that they were still thinking about reducing their use, or thinking of reducing use even further.

While behavior change was not a study outcome, we investigated whether the brief intervention led to small changes in readiness for some of the constructs. Given this was a pilot study, the sample size was small, and the study was not powered to assess changed in stage of change or behavior, we did not expect behavior change on such a short time frame. However, examining the distribution of stage data, it appears that there was some movement across stage. Patients did appear to move from Precontemplation to

contemplation and preparation for the reduction of alcohol use. It also appears that patients did not move through the stages of change for all constructs in a direction that would indicate that the program had an effect on motivating behavior change. Other constructs that may have been assessed at follow-up were left out due time constraints. It would have been valuable to know whether the physician planned to follow-up with patients for specific behavioral issues, whether they prescribed medication or if patients were referred for further psychological interventions. These results are preliminary at best as the sample is just too small to draw any conclusions on differences of stages of change.

Overall, the MASCOT program appears to have engaged patients and the physician in discussions of risky behaviors. In order for health behavior interventions to be successful, they need to be engaging to their intended audience and potentially easily disseminated. The MASCOT program represents just such an intervention that has the potential to have a positive impact on public health by providing opportunity for intervention via pediatric primary care, addressing key mental and behavioral health risks with the potential to reduce morbidity and mortality from these important risk areas. More studies evaluating computer delivered assessment and tailored feedback for mental and behavioral health risks are needed in order for an integration of tools like the MASCOT system into regular pediatric primary care practice. Collaborative efforts must address all of the stakeholders' needs including patients, physicians policy makers, public health professionals, mental health professionals, health care organizations and health care delivery systems.

Considerations for iterative improvements and evaluation of the MASCOT system would include improving ease of use for the physician to better integrate into the office workflow as well as making the system more user friendly for the patients. Other goals for further development of the MASCOT system include assessing whether the physician planned to follow-up with patients for behavioral issues, whether they prescribed medication or if they were referred for further psychological interventions. Then, after additional feasibility testing, the MASCOT program could be tested in an efficacy trial with the focus of identifying key areas of health behavior change that adolescents could address independently and in collaboration with their physicians to address improve health. A larger efficacy trial would be designed as an experiment with a control group and would be sufficiently powered to be able to examine efficacy for movement through the stages of change. Use of the latest computer technologies are essential to maintain the attractiveness to the patients. A more user friendly platform should be considered for the physicians' benefit and utilization of a platform that interfaces with the office electronic medical records would be desirable. Progress in implementing behavioral health integration would also need to include education of physicians how to administer particular assessments and treatments, acquaint intervention researcher developers with the needs and limitations of the delivery systems, and educate the general population on the importance of behavioral health integration. Documenting the evidence of successful integration efforts will support the advocacy for policy changes including increasing reimbursement rates to physicians for behavioral health interventions. Finally, this program development approach to the development, design and piloting of the MASCOT system of has demonstrated initial feasibility and

acceptability. Future research on the MASCOT system is well-supported by this pilot project that shows significant promise for the use of computer tailored theory driven interventions for mental and behavioral health in pediatric primary care.

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Appendix A Key Informant Interview

We are designing a tablet-based intervention for the health promotion of children and adolescents. The proposed project will target all youth aged 10 and up at their well-care visit. The goal is to promote a healthy lifestyle to prevent and/or reduce emotional disorders and risk taking behaviors in a pediatric population. In order to build a theory-based intervention that supports the physician process, we are seeking information on the current practice of behavioral assessment and treatment as well as the possible utility of a tablet-based intervention in a pediatrician's office. We appreciate your input and will maintain your confidentiality.

1. How long are patients in your waiting area?
2. How long are patients in the exam room alone?
3. How long is a standard well-care physical appointment?
4. How much time is spent on assessing for emotional disorders at a well-care visit?
5. How much time is spent on assessing for risk behavior at a well-care visit?
6. Do you currently assess for the following risk-taking behaviors?

□ yes □ no Eating disorders
□ yes □ no Alcohol use
□ yes □ no Marijuana use
□ yes □ no Cigarette use
□ yes □ no Caffeine use
□ yes □ no Sex practices
□ yes □ no Other _____

7. Do you currently assess for the following emotional disorders?

□ yes □ no Depression
□ yes □ no Anxiety
□ yes □ no Other _____
□ yes □ no Other _____

8. If you do assess for emotional disorders and risk-behaviors, what is the current assessment method?

_____

_____

9. If you do assess for emotional disorders and risk-behaviors, what is the current treatment method?

_____

_____

10. If a tablet were available to assess for emotional disorders and risk-behaviors prior to meeting with a patient, what would you like to see in an assessment report?

□ yes □ no Yes/No Reponses
□ yes □ no Severity of symptoms/use
□ yes □ no Duration of symptoms/use
□ yes □ no Motivation to change symptoms/use
□ yes □ no Other _____
□ yes □ no Other _____

11. If you were able to quickly conduct an assessment on emotional disorders and risk-taking behaviors using a tablet while the patient was waiting to see you, and it were able to provide relevant and desired feedback to you, as well as feedback to promote healthy behaviors to the patient (such as the benefits of exercise, stress management and eating healthy) would you be willing to implement it in your office?

□ yes □ no

12. How much time would you allot for this tablet driven assessment and feedback?

_____

_____

13. Would you prefer electronic feedback or a hard copy paper format?

_____

14. Would you be willing to refer your patients to connect to an on-line system for further health promotion?

□ yes □ no

Appendix B Narragansett Bay Assessment

Adolescent Behavioral Screen Ages13-20

This survey is confidential and will not be shown to anyone outside of the practice. Please respond honestly to the following statements regarding your feelings and/or actions over the past 6 months.

Male □ Female □ Age _____

FEELINGS

	NEVER	SOMETIMES	OFTEN
Sad, down, depressed	□	□	□
Attempts to hurt yourself/cutting	□	□	□
Increased anxiety/nervousness	□	□	□
Increased irritability, arguments, fights	□	□	□

	NO	YES
Feeling fat	□	□
Terrified of being overweight	□	□

ALCOHOL	NO	YES
Do you drink alcohol?	□	□

If yes, please answer the questions below:

How often do you drink alcohol?	1x/month	2-4x/month	2-3x/week	5x/week or more
	□	□	□	□

How many alcoholic drinks do you have on a typical occasion?

1-2	3-4	5-6	7-9	10+
□	□	□	□	□

	NO	YES
Ridden/driven in a car when driver had used alcohol or drugs	□	□
Used alcohol/drugs to relax, fit in, or to feel better about yourself	□	□
Ever used alcohol or drugs while you are alone	□	□
Friends or family ever tell you to cut back your use of alcohol or drugs	□	□
Ever forget things you did while using alcohol or drugs	□	□
Ever got in trouble while you were using alcohol or drugs	□	□

Appendix C. Revised Narragansett Bay Assessment

In the past year I have…	**Always**	**Often**	**Some-times**	**Never**
felt sad	3	2	1	0
had thoughts of hurting myself	3	2	1	0
attempted to hurt myself	3	2	1	0
felt worried, anxious or nervous	3	2	1	0
been irritable, angry & fought with those close to me	3	2	1	0

In the past year I have…	**Always**	**Usually**	**Often**	**Some-times**	**Rarely**	**Never**
avoided eating when I am hungry	5	4	3	2	1	0
gone on eating binges where I feel that I may not be able to stop.	5	4	3	2	1	0
vomited after I have eaten	5	4	3	2	1	0
felt that others would prefer if I ate more	5	4	3	2	1	0
found myself preoccupied with being thinner	5	4	3	2	1	0

In the past three months I have had…	**Every day**	**1-2 times per week**	**1-3 times per month**	**1-2 times**	**Never**
12 or more drinks of alcohol	4	3	2	1	0
8-12 drinks of alcohol	4	3	2	1	0
5-7 drinks of alcohol	4	3	2	1	0
3-4 drinks of alcohol	4	3	2	1	0
1-2 drinks of alcohol	4	3	2	1	0

How many cigarettes or mini cigars do you smoke per day?	**More than 25**	**16-25**	**1-15**	**Less than one per day**	**0**
Do you currently use chewing tobacco	**Yes**	**No**			

In the past three months I have smoked pot…	**Every day**	**1-2 times per week**	**1-3 times per month**	**1-2 times**	**Never**

In a typical day, how many days do you do 60 minutes or more of physical activity?	0	1	2	3	4	5

I currently drink this amount of caffeinated beverages (Coke, Redbull, etc.) **per day**	More than 8	5-7	3-5	1-2	0

What time do you go to sleep? __:__ __

What time do you wake up? __:__ __

Appendix D. Complete MASCOT assessment

Please select the response that best fits about how you have been feeling:

In the **past year** I have…	Always	Often	Sometimes	Never
felt sad	3	2	1	0
had thoughts of hurting myself	3	2	1	0
attempted to hurt myself	3	2	1	0
felt worried, anxious or nervous	3	2	1	0
been irritable, angry & fought with those close to me	3	2	1	0

Please select the response to each question that best fits about how you have been eating:

In the **past year** I have…	Always	Usually	Often	Sometimes	Rarely	Never
avoided eating when I am hungry	5	4	3	2	1	0
gone on eating binges where I feel that I may not be able to stop.	5	4	3	2	1	0
vomited after I have eaten	5	4	3	2	1	0
felt that others would prefer if I ate more	5	4	3	2	1	0
found myself preoccupied with being thinner	5	4	3	2	1	0

Please select the best response about smoking:

How many cigarettes or mini cigars do you smoke **per day**?	More than 25	16-25	1-15	Less than one per day (you have tried it once or smoke rarely)	0 (Never tried to smoke)

Please select the best response about caffeine:

I currently drink this amount of caffeinated beverages (Coke, Redbulll, etc.) **per day**	More than 8	5-7	3-5	1-2	0

Please select the best response about your sleeping habits:

In a **typical night**, how many hours of sleep do you get?	4	5	6	7	8	9+

Now we will ask you some questions about physical activity. Physical activity is any activity that increases your heart rate and makes you get slightly out of breath.

Physical activity can be done while playing sports, playing with friends or walking to school. Some examples are running, brisk walking, rollerblading, biking, skateboarding, dancing, swimming, soccer, basketball, football and surfing.

Physical activity can be accumulated over the course of the day. For example, rather than doing 60 minutes all at once, you could do six 10-minute sessions or two 30-minute sessions.

When answering these questions, do NOT count time you spend in gym class at school.

In a typical week, how many days do you do 60 minutes or more of physical activity?

0 days	1 day	2 days	3 days	4 days	5 days	6 days	7 days

If 0-4 days of exercise please answer:

Do you plan to start doing 60 minutes or more of physical activity on at least 5 days of the week?

No, I do not plan to start in the next 6 months.	
Yes, I plan to start in the next 6 months.	
Yes, I plan to start in the next 30 days.	

If 5-7 days of exercise please answer: (if 0-4 days skip to next)

How long have you been doing 60 minutes or more of physical activity on at least 5 days of the week?

Less than 6 months	
6 months or more	

Next are some thoughts and feelings people might have about doing 60 minutes or more of physical activity at least 5 days of the week. Please tell us how important each one is in **your decision** about whether or not to do 60 minutes or more of physical activity on at least 5 days of the week.

If I decided to do 60 minutes or more of physical exercise on at least 5 days of the week…

	Not important **at all**	**A little** important	Important	**Very** important	**Extremely** important
I'd be in a better mood					
I'd feel better about myself					
I'd have to buy sneakers or workout clothes.					
I'd stay in shape.					
I might be embarrassed to do a physical activity in front of others.					
I'd have more energy.					
It would take too much energy.					
Others might feel guilty if they weren't doing that much physical activity.					

Next are some situations that might make it hard to do 60 minutes or more of physical activity on at least 5 days of the week. Please tell us how confident you are that you could

Have you ever tried marijuana in your life?	Yes	No

do 60 minutes or more of physical activity on at least 5 days of the week.

How confident are you that you could do 60 minutes or more of physical activity on at least 5 days of the week if…

	Not at all confident	**A little** confident	Confident	**Very** confident	**Extremely** confident
You were on a break from school?					
You were busy?					
You didn't feel like exercising?					
The weather was bad?					
You just wanted to chill?					
You had to exercise alone?					

Please answer the following questions about marijuana (also known as pot or weed)

If yes answer questions below; (If no, skip to page 12)

How many times have you used marijuana in the past 30 days?

0	1-2 times	3-9 times	10-19 times	20-39 times	40+ times

Anything more than zero, answer below:

I do NOT plan to reduce or stop using marijuana within the next six months.	
I plan to reduce or stop using marijuana within the next six months.	
I plan to reduce or stop using marijuana within the next 30 days.	
I have already reduced or stopped using marijuana, but have been doing so for less than six months.	
I have reduced or stopped using marijuana for 6 months or longer.	

Next are some thoughts and feelings people might have about stopping their marijuana use. Please tell us how important each one is in **your decision** about whether or not to stop using marijuana.

If I decided to NOT use marijuana…

	Not important **at all**	**A little** important	Important	**Very** important	**Extremely** important
I might feel better about myself.					
I might have to find other ways to deal with my problems.					
Others would respect me more.					
I might not have an excuse for the way that I act.					
I wouldn't risk becoming addicted.					
I might have less fun.					
I would have more control over my life.					
My friends might not feel as close to me.					

If you answered that you have never tried marijuana, please answer the following:

Have you been thinking about or planning to try marijuana within the next 60 days.	Yes	No
Have you been thinking about or planning to try marijuana within the next 30 days.	Yes	No

If yes to either, please rate how tempted you would be in the following situations to try marijuana.

How tempted would you be to use marijuana if…

	Not at all tempted	**A little** tempted	Tempted	**Very** tempted	**Extremely** tempted
You were around others who were trying or using marijuana?					
You were curious?					
You weren't feeling good about yourself?					
You saw others doing it and nothing bad was happening to them?					
You wanted to have fun?					
You thought you wouldn't get caught?					

The next set of questions will be about stress and coping with stress.

In the last month, how often was each statement true of your own life?

	Never	**Seldom**	**Occasionally**	**Often**	**Frequently**
I felt there was not enough time to complete my daily tasks.					
I felt I had more stress than usual.					
I took on more than I could handle.					
I felt overwhelmed.					
I was pressured by others.					
I felt stressed by unexpected events.					
I had no time to relax.					
I successfully solved problems that came up.					
I was able to cope with unexpected problems.					
I was able to cope with difficult situations.					
I felt able to meet demands.					
I felt able to cope with stress.					

Effective stress management is defined as successfully dealing with stress in daily life. Some examples of healthy ways to relax and recharge are to go for a walk, spend time in nature, call a good friend, sweat out tension with a good workout, write in your journal, take a long bath, savor a warm cup of hot cocoa or tea, play with a pet, work in your garden, get a massage, curl up with a good book, yoga, listen to music or watch a comedy.

Please select which best describes where you are in thinking about managing your stress…

I do NOT plan to practice stress management within the next six months.	
I plan to practice stress management within the next six months.	
I plan to practice stress management within the next 30 days.	
I am already practicing stress management, but have been doing so for less than six months.	
I have been practicing stress management for 6 months or longer.	

Next are some situations that might make it hard to practice stress management.

Please tell us how confident you are that you could practice stress management if…

	Not at all confident	**A little** confident	Confident	**Very** confident	**Extremely** confident
Things are not going the way I want.					
I have been sick a lot.					
I am frustrated.					
I am anxious.					
I am depressed.					
I am overwhelmed with all that I have to do.					
A friend or family member is upset with me.					
I experience trouble at school.					

Please answer the following about alcohol use.

Have you ever tried alcohol? **Yes** **No**

If yes;

In the past three months I have had…	**Every day**	**1-2 times per week**	**1-3 times per month**	**1-2 times**	**Never**
12 or more drinks of alcohol	4	3	2	1	0
8-12 drinks of alcohol	4	3	2	1	0
5-7 drinks of alcohol	4	3	2	1	0
3-4 drinks of alcohol	4	3	2	1	0
1-2 drinks of alcohol	4	3	2	1	0

Never drinker/Experimental drinker = answered ((0) Never) to every question or answered ((1) 1-2 Times) to the question of 1-2 drinks of alcohol or 3-4 drinks of alcohol.

Current/former drinker = answered ((1) to 8-12 or 12 + drinks or (2, 3, or 4)) to any question

*If **Current/former drinker**, please select where you are in your thinking of cutting down or quitting drinking. (If not, skip to page 19)*

I do NOT plan to reduce or stop my drinking within the next six months.	
I plan to reduce or stop drinking within the next six months.	
I plan to reduce or stop drinking within the next 30 days.	
I have already reduced or stopped drinking, but have been doing so for less than six months.	
I have reduced or stopped my drinking for 6 months or longer.	

Next are some thoughts and feelings people might have about stopping their alcohol use. Please tell us how important each one is in **your decision** about whether or not to stop using alcohol.

Please rate how much you agree or disagree…

	Strongly disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
I will make better decisions without alcohol.					
I will have more fun if I drink alcohol.					
If I don't drink alcohol, I will be a better role model.					
I will have more friends if I drink alcohol.					
My parents would be proud of my choice to not drink.					
I will feel more like an adult if I drink alcohol.					

*If **Never/Experimental drinker**, please select where you are in your thinking of or planning to drink alcohol.*

Have you been thinking about or planning to try alcohol within the next 60 days.	Yes	No
Have you been thinking about or planning to try alcohol within the next 60 days.	Yes	No

If yes to either, please rate how tempted you would be in the following situations to try alcohol.

How tempted would you be to use alcohol if…

	Not at all tempted	**A little** tempted	Tempted	**Very** tempted	**Extremely** tempted
I am with others my age that are trying alcohol.					
When other people encourage me to try a drink.					
When I am offered a drink by someone.					
When I am home alone.					
When I am bored.					
When I am anxious about meeting people.					
When I am feeling shy.					
When I am nervous about being around friends or relatives.					

Appendix E. Stage-Based Feedback Content for MASCOT System

Marijuana Stage of Change for Cessation

Individuals who answer that they have used marijuana within the past 30 days will receive the following feedback based on their stage of change:

(Pre-contemplation): "You said that you have no intention to stop using marijuana in the next six months."

(Contemplation): "You said that you intend to stop using marijuana in the next 6 months, but not in the next 30 days. It's great that you are thinking about stopping your marijuana use. Approximately 74% of teens your age in Rhode Island are not using marijuana currently""

(Preparation): "You said that you intend to stop using marijuana in the next 30 days. Congratulations on preparing to stop using marijuana. Approximately 74% of teens your age in Rhode Island are not using marijuana currently""

(Action): "You said that you have used marijuana in the last 6 months, but not in the last 30 days. Congratulations for taking action to stop using marijuana. Approximately 74% of teens your age in Rhode Island are not using marijuana currently either"

(Maintenance): "You said that you have not used marijuana in the last 6 months. Congratulations. You, are not currently using marijuana like the majority of teens your age in Rhode Island (74%) are not using marijuana.

Marijuana Stage of Change for Acquisition

Individuals who have never used marijuana or have not used marijuana in the past 30 days will answer their stage of change based on their intention to try marijuana within the next 6 months or 30 days. They will receive the following feedback based on their stage of change:

(Acquisition-Precontemplation): "You said that you have no intention to try marijuana in the next 6 months. That's great because most teens your age in Rhode Island have never tried marijuana (60%) and even less are currently using marijuana (74%)."

(Acquisition-Contemplation): "You said that you were thinking about trying or plan to try marijuana within the next 6 months. Did you know that 60% of teens your age in Rhode Island have never tried marijuana? Even more teens your age are not currently using marijuana (74%)."

(Acquisition-Preparation): "You said that you are thinking about trying or plan to try marijuana within the next 30 days. Did you know that 60% of teens your age in Rhode

Island have never tried marijuana? Even more teens your age are not currently using marijuana (74%)."

Alcohol Stage of Change for Cessation

Individuals who answer that they have used alcohol within the past 30 days will receive the following feedback based on their stage of change:

(Pre-contemplation): "You said that you have no intention to stop drinking in the next 6 months."

(Contemplation): "You said that you intend to stop drinking in the next 6 months, but not in the next 30 days. It's great that you are thinking about stopping drinking. More teens your age in Rhode Island do not drink alcohol (66%) than do drink alcohol."

(Preparation): "You said that you intend to stop drinking in the next 30 days. Congratulations for thinking about taking steps to stop drinking alcohol. Did you know that more teens your age in Rhode Island do not drink alcohol (66%) than do drink alcohol?"

(Action): "You said that you have used alcohol in the last 6 months, but not in the last 30 days. Congratulations for taking steps to stop drinking. More teens your age in Rhode Island do not drink alcohol (66%) than do drink alcohol."

(Maintenance): "Congratulations! You have not used alcohol in the last 6 months. You are like most teens your age in Rhode Island (66%) that do not drink alcohol."

Alcohol Stage of Change for Acquisition

Individuals who have never used alcohol or have not used alcohol in the past 30 days will answer their stage of change based on their intention to try alcohol within the next 6 months or 30 days. They will receive the following feedback based on their stage of change:

(Acquisition-Precontemplation): "You said that you are not thinking about trying alcohol within the next 6 months. That's great. Did you know that 66% of teens your age in Rhode Island are not using alcohol?"

(Acquisition-Contemplation): "You said that you are thinking about or planning to try drinking within the next 6 months. Did you know that most teens your age in Rhode Island (66%) are not using alcohol?

(Acquisition-Preparation): "You said that you are thinking about or planning to try drinking within the next 30 days. Did you know that most teens your age (66%) are not

using alcohol? Also, almost 40% of teens your age have never even tried one drink of alcohol during their lifetime?"

Everyone will receive feedback on Exercise Acquisition to promote healthy behaviors among all patients. They will receive the following feedback based on their stage of acquisition first:

(Acquisition-Precontemplation): "You said that you are not thinking about doing 60 minutes or more of physical activity within the next 6 months. Regular exercise helps to feel less stressed, more energy, better about ourselves, more ready to learn in school, keep a healthy weight, improve our mood, build and keep healthy bones, muscles and joints and sleep better at night. We can get exercise by playing competitive sports or just by walking, biking, dancing, bowling or practicing yoga. Experts recommend that teens get 60 minutes or more of moderate to vigorous physical activity each day. "

(Acquisition-Contemplation): "You said that you are thinking about or planning to do 60 minutes or more of physical activity within the next 6 months. That's great. About 73% of teens your age do at least 60 minutes of exercise at least once per week. Regular exercise helps to feel less stressed, more energy, better about ourselves, more ready to learn in school, keep a healthy weight, improve our mood, build and keep healthy bones, muscles and joints and sleep better at night. We can get exercise by playing competitive sports or just by walking, biking, dancing, bowling or practicing yoga. Experts recommend that teens get 60 minutes or more of moderate to vigorous physical activity each day."

(Acquisition-Preparation): You said that you are thinking about or planning to do 60 minutes or more of physical activity within the next 30 days. That's great. About 73% of teens your age do at least 60 minutes of exercise at least once per week. Regular exercise helps to feel less stressed, more energy, better about ourselves, more ready to learn in school, keep a healthy weight, improve our mood, build and keep healthy bones, muscles and joints and sleep better at night. We can get exercise by playing competitive sports or just by walking, biking, dancing, bowling or practicing yoga. Experts recommend that teens get 60 minutes or more of moderate to vigorous physical activity each day."

Exercise Acquisition to maintain

(Acquisition-action): "You said that you have been doing 60 minutes or more of physical activity or more for less than 6 months. That's great. About 73% of teens your age do at least 60 minutes of exercise at least once per week. Regular exercise helps to feel less stressed, more energy, better about ourselves, more ready to learn in school, keep a healthy weight, improve our mood, build and keep healthy bones, muscles and joints and sleep better at night. We can get exercise by playing competitive sports or just by

walking, biking, dancing, bowling or practicing yoga. Experts recommend that teens get 60 minutes or more of moderate to vigorous physical activity each day."

(Acquisition-maintenance): "You said that you have been doing 60 minutes or more of physical activity for 6 months or more. That's great. About 73% of teens your age does at least 60 minutes of exercise at least once per week. Regular exercise helps to feel less stressed, more energy, better about ourselves, more ready to learn in school, keep a healthy weight, improve our mood, build and keep healthy bones, muscles and joints and sleep better at night. We can get exercise by playing competitive sports or just by walking, biking, dancing, bowling or practicing yoga. Experts recommend that teens get 60 minutes or more of moderate to vigorous physical activity each day."

Everyone will receive feedback on Stress Management to promote healthy behaviors among all patients. They will receive the following feedback based on their stage of acquisition first:

(Acquisition-Precontemplation): "You said that you are not thinking about practicing stress management within the next 6 months. Stress management has many physical and emotional benefits. Stress management techniques can include physical exercise, yoga, meditation, deep breathing exercises, listening to calming music, or talking to someone you trust.""

(Acquisition-Contemplation): "You said that you are thinking about or planning to practice stress management within the next 6 months. That's great. Stress management has many physical and emotional benefits. Stress management techniques can include physical exercise, yoga, meditation, deep breathing exercises, listening to calming music, or talking to someone you trust."

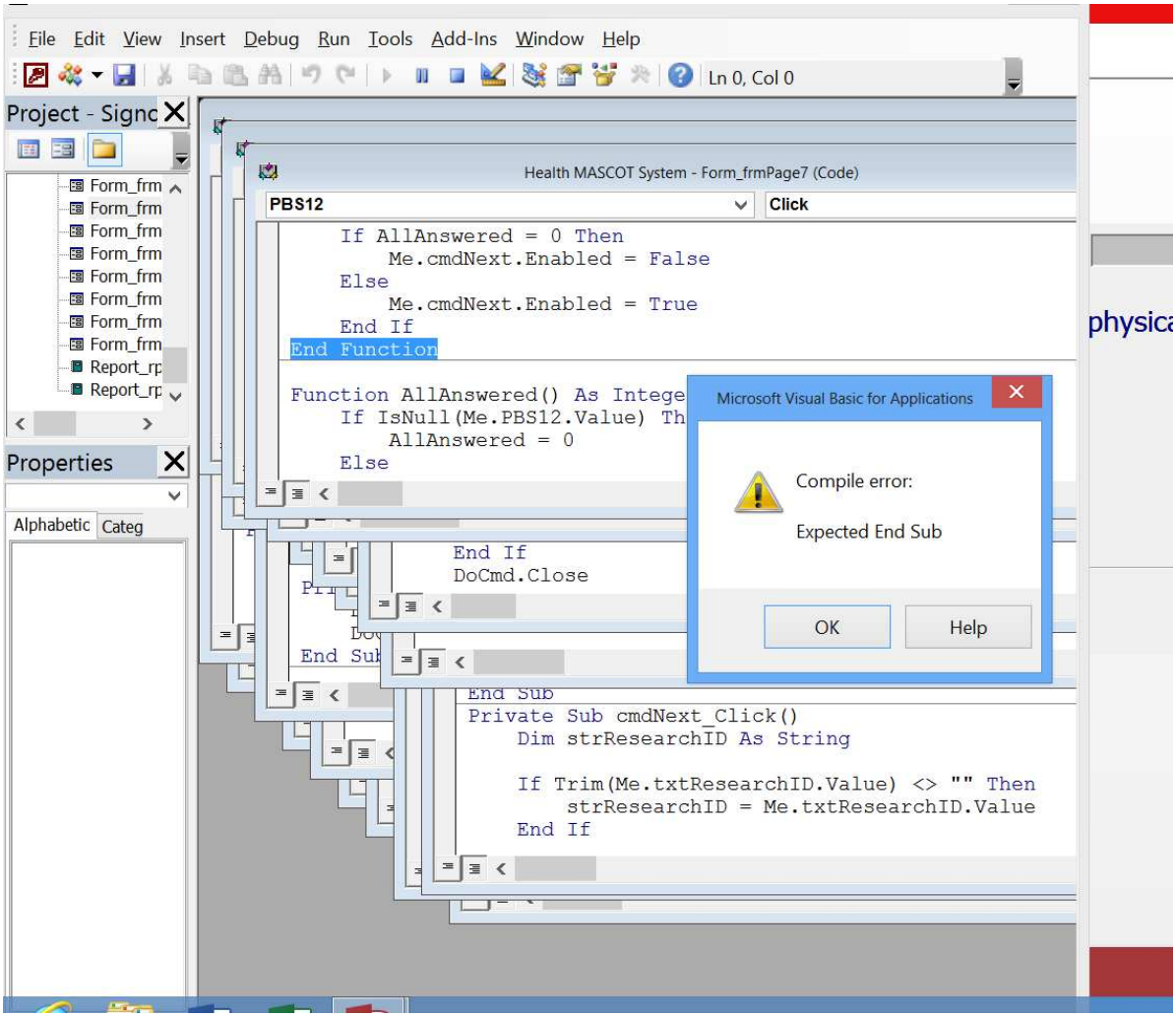
(Acquisition-Preparation): "You said that you are thinking about or planning to practice stress management within the next 30 days. That's great. Stress management has many physical and emotional benefits. Stress management techniques can include physical exercise, yoga, meditation, deep breathing exercises, listening to calming music, or talking to someone you trust."

(Acquisition-action): "You said that you have been practicing stress management for less than 6 months. Congratulations for taking steps to manage your stress and cope in a healthy way. That's great. Stress management has many physical and emotional benefits. Stress management techniques can include physical exercise, yoga, meditation, deep breathing exercises, listening to calming music, or talking to someone you trust."

(Acquisition-maintenance): Congratulations! You said that you have been practicing stress management for 6 months or more. That's great. Stress management has many physical and emotional benefits. Stress management techniques can include physical

exercise, yoga, meditation, deep breathing exercises, listening to calming music, or talking to someone you trust. Keep up the good work!”

Appendix F. Error Message during testing phase



Appendix G. Screen Shot of MASCOT questionnaire for Eating Disordered Behavior