
Interactive Behavior Change Technology

A Partial Solution to the Competing Demands of Primary Care

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Background: Primary care practices are faced with the challenge of having too much to do in too little time. As a result, behavioral counseling is often overlooked, especially for patients with multiple health behaviors in need of change.

Methods: This paper describes recent examples of the application of interactive behavior change technologies (IBCTs) to deliver health behavior change counseling before, during, and after the office visit to inform and enhance patient–clinician interactions around these issues. The 5A’s framework (assess, advise, agree, assist, arrange follow-up) is used to consider how interactive technology can be used to implement behavior change counseling more consistently.

Results: A variety of IBCTs, including the Internet, clinic-based CD-ROMs, and interactive voice-response telephone calls have been shown to be feasible and potentially valuable adjuncts to clinic-based behavioral counseling. These technologies can both increase the effectiveness of behavioral counseling and extend the reach of these services to patients with barriers to face-to-face interactions.

Conclusions: If appropriately developed with the context of primary care in mind and integrated as part of a systems approach to intervention, IBCT can be a feasible and appropriate aid for primary care. Recommendations are made for the types of IBCT aids and research that are needed to realize this potential.

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Introduction

Primary care physicians and healthcare systems face substantial barriers to providing preventive services. Given the competing demands for management of acute illnesses and chronic health conditions, Stange et al.¹ have concluded that 1 minute is the realistic average amount of time that primary care providers can devote to prevention during a typical office visit.¹ Rather than argue that more time should be devoted to prevention, they argue that this “1 minute for prevention” should be leveraged, supported, and informed by activities outside the face-to-face encounter. Another recent paper demonstrates that to deliver all the preventive services recommended by the U.S. Preventive Services Task Force² (USPSTF) to an average panel of patients, family physicians would need to spend 7.5 hours of every working day on prevention.³ These articles demonstrate the impossibil-

ity of relying on primary care physicians to deliver personally all the recommended and guideline-concordant preventive services. They also provide a sobering juxtaposition to the series of articles in this issue describing the prevalence, importance, and effectiveness of methods to assist patients to change multiple health risk behaviors.^{4,5} Given the complexity and challenges of behavior change for patients who have multiple behaviors to change or multiple chronic illnesses,^{6,7} thoughtful use of interactive behavior change technology (IBCT) might provide a partial solution to the otherwise overwhelming problem of addressing prevention effectively in primary care.

By IBCT we mean computer-based tools and systems, including hardware and software that can be used to address health behavior change. Examples include, but are not limited to, Web-based behavior change programs; CD-ROM interventions using touchscreen kiosks or similar methods; interactive voice response (IVR) technologies, also known as automated telephone disease management; personal digital assistants (PDAs) or other handheld devices, electronic medical records or registries that include behavioral and behavior change information, and a variety of emerging “convergence” devices that merge or combine the characteristics of these different technologies.⁸

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The purposes of this article are to (1) describe a model of how IBCT can inform, deliver and support behavior change counseling; (2) discuss recent applications of IBCT; (3) illustrate innovative ways that IBCT can be used to leverage the “1 minute for prevention”¹; and (4) propose future directions for research and application. It is not our intent to provide a systematic review of the literature on IBCT; this is worthy of a separate paper. The article by Goldstein et al.⁵ in this issue provides evidence from IBCT (as well as many other interventions) and reviews of IBCT are available.^{9–11} The *American Journal of Preventive Medicine* has published a series of articles on the development and status of IBCT,^{12–15} and entire books have been written on the potential for integrating IBCT into health care and on the evidence supporting IBCT.^{9,10} This article focuses on the narrower question of how IBCTs can be integrated within primary care practices to address the challenge of multiple behavior change.

“5A’s” Intervention Model and Framework

As described in accompanying articles^{4,16} and recommended by the USPSTF on health behavior counseling,¹⁷ the 5A’s model (assess, advise, agree, assist, arrange follow-up) provides a helpful framework for conceptualizing and delivering evidence-based behavior change interventions. These sequential and ongoing activities include assessing current patient health behaviors, advising them in personally relevant ways to change health behaviors that put them at risk, agreeing with patients on collaboratively set, specific behavior change goals, assisting them with problem-solving strategies to overcome barriers to attaining these goals, and arranging follow-up support so that achieved behavior changes are maintained over time.^{17–19}

Interactive behavior change technologies can be used to deliver the 5A’s consistently within the context of primary care. Our primary thesis is that modern IBCT can be used effectively and efficiently to provide behavior change support before, during, and after primary care office visits—and sometimes instead of such visits (Figure 1). If appropriately constructed to draw on the strengths of primary care,^{20,21} and to use patient-centered principles,^{22,23} IBCT can inform, leverage, and support patient-provider communication and enhance behavior change.¹

Table 1 provides a summary of the purpose of each of the 5A’s of behavior change, and our estimation of the relative strengths and limitations of each of the more widely used IBCT platforms (as typically constructed and used in 2004) on these categories.²⁴ We also encourage readers to think about creative ways that these various technologies can be combined to support primary care and to assist patients and healthcare teams to address multiple behavior risk factors.

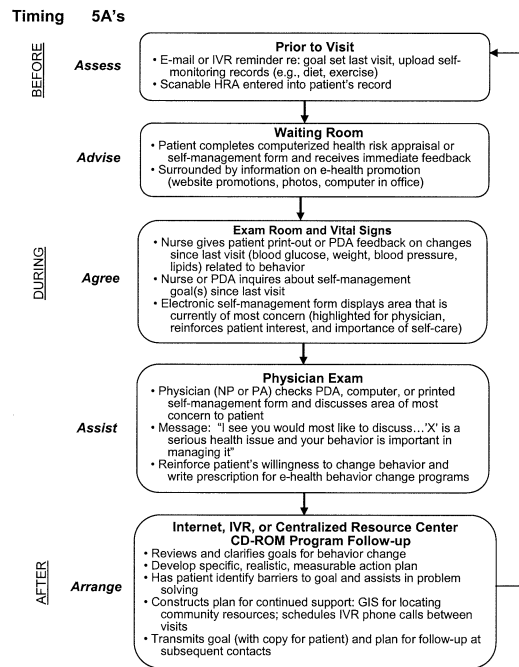


Figure 1. Examples of using interactive technology to support multiple health behavior counseling before, during, and after office visits.

Using IBCT Before an Office Visit

Interactive behavior change technology can be particularly useful before the clinic visit to promote assessment, the first of the 5A’s. Primary care practices can take advantage of IBCT to assess and promote behavior change even before a client steps into the office. Patients may use the telephone, a clinic Website, or a CD-ROM in the office before the visit to complete a health behavior risk assessment (HRA). HRAs have been effective in facilitating behavior change when coupled with feedback and behavior change support.^{25–27} IBCT can facilitate this process and take it a step further by using preprogrammed algorithms to individually tailor feedback based on participant responses. For example, a person who indicates that they regularly engage in moderate physical activity may get feedback that offers positive reinforcement, while a person who does little physical activity may get a message with suggestions for how to gradually incorporate physical activity into their lifestyle. There is a substantial literature documenting the effectiveness of such “tailored messages,”^{28–36} although not all reviews are positive,^{11,37} and work remains to determine specifically what types of tailoring are most effective.

Research has shown that tailoring print materials to reflect individual characteristics increases the relevance of material for subjects; that such material is more likely to be read, comprehended, and remembered; and that it can produce significant behavior change^{11,35,36,38,39} across a wide variety of behavioral outcomes (e.g.,

Table 1. Strengths and limitations of various IBCTs on each 5A's dimension

IBCT modality	Assess	Advise	Agree	Assist	Arrange
Purpose	Obtain data on behaviors and preferences	Recommend changes tied to patient lab results and values	Set goals collaboratively with patient	Identify barriers and develop action plan	Provide follow-up support and resources
Internet					
E-mail	Weak	Moderate	Moderate	Moderate	Strong
Website	Strong	Strong	Strong	Strong	Weak–Moderate
CD-ROM	Strong	Strong	Strong	Strong	Weak
Office PDA	Moderate	Weak	Moderate	Weak	Weak–Moderate
Tailored print	Moderate	Strong	Moderate	Moderate	Strong
Interactive voice response (phone)	Strong	Moderate	Moderate	Moderate	Strong

CD-ROM, compact disk-read-only memory; IBCT, interactive behavior change technologies; PDA, personal digital assistant.

smoking cessation, diet and nutrition, physical activity, cancer screening). Patients can receive tailored feedback about possible goals for behavior change and the strategies to achieve them, and can take this risk assessment further by selecting one or two behavior change areas for goal setting, printing out these goals, and discussing them with their healthcare team.^{40,41} Tailored printouts can also be designed for providers. For example, “Mr. Smith has two goals after completing his HRA: to increase his physical activity to 4 days per week and to replace butter with olive oil in his diet.” This information could be delivered to both parties using IBCT through multiple modalities—for instance, patients completing an HRA online could get their tailored feedback online or as a printout, while the information relevant for a provider is automatically sent via e-mail or automatically entered into the electronic medical record. Such approaches to multiple distribution of tailored feedback set the stage for shared and informed decision making.

Primary care practices or health plans could also develop practice Websites to take advantage of multiple opportunities and modalities, such as e-mail, to communicate with patients even before they ever see them face-to-face, potentially improving patient satisfaction^{13,15,38} and the effectiveness of provider–patient communication. While the up-front costs to develop and program a Website can be substantial, the ability to keep current information online and the low to moderate costs of maintaining a Website (costs can, however, vary greatly, depending on how this is done, how often, and who does it) can facilitate returns on the initial investment. Providers need to take precautions to ensure confidentiality online, particularly in light of the new Health Information Portability and Accountability Act (HIPAA) Privacy Rule. However, the security available online likely exceeds that of a traditional locked office and file cabinet system for protection of medical records. Many opportunities exist to share information with prospective and current patients that

could save time for front office staff, and when working with patients having multiple behavioral health risks. The frequently asked questions (FAQ) page on most Websites could cover key information items for the practice, such as insurance issues, parking, transportation, and what to expect during the office visit. Practices also could provide sample question lists that patients could adapt, print, and bring with them to an office visit.⁴² With increasing frequency, patients log on to the Web and become informed (or misinformed) very quickly about health issues. Practices with Websites could ensure that patients receive the most reliable information by putting links to relevant, reputable sources on their clinic Website. This could also boost patient satisfaction by communicating that the practice encourages this kind of health information seeking.

Another approach might be to use interactive voice response (IVR) technology to elicit pre-visit expectations, questions, and goals. IVR uses computer-based telephone systems to call, receive calls, provide information, and collect data from users. Many patients (especially new patients or those with multiple behavior change goals or multiple illnesses) have so much to cover during a visit that their visit often ends before they can raise important concerns or questions. To prevent this, patients could receive an IVR call before a visit, in which they are asked to identify their priorities and expectations for the visit. Their answers could then be inserted into the medical record so that they are available to the clinician at the time of the encounter. Although these ideas may seem far from actual implementation, it is intriguing to think of possible ways a primary care practice could harness the potential of IBCT to enhance assessment. Also, the IVR example is similar to methods employed in large healthcare systems by Piette et al.^{43,44} As with any communication modality, including traditional phone calls, there are HIPAA issues that need to be addressed, but many healthcare plans have dealt with these and are currently using IVR systems.

Use of IBCT After the Visit

After a clinic visit, many primary care encounters require arranging follow-up for successful behavior change. Unfortunately, this follow-up seldom occurs.⁴⁵ IBCTs are well adapted to this task. While IBCT applications often serve multiple clinical goals, it is useful to appreciate the distinct care processes that IBCT can support.

Use of IBCT for Ongoing Assessment and Monitoring

Most treatments initiated or modified during outpatient visits can only be evaluated based on patients' status and well-being after the encounter. For example, medication titration for alcohol abuse, weight management, or tobacco addiction requires post-visit assessments to identify improvements in the target condition as well as for development of side effects suggesting the need for treatment changes. Regardless of treatment effects, patients' physiologic health, well-being, and social context change over time, and ongoing monitoring is essential to ensure that treatment plans remain relevant to individuals' needs. Unfortunately, patients in most healthcare systems have sole responsibility for reporting changes in their health, health behaviors, and social supports. Even when proactive follow-up is attempted (e.g., through nursing or other allied health telephone calls), service demand and logistical issues can outstrip available resources. Individuals who are the most difficult to reach (many of whom may have the greatest need for follow-up) become the least likely to be monitored effectively. Socioeconomically vulnerable patients (e.g., non-English speakers or the frail elderly) are especially at risk. As a result, healthcare systems often fail to identify prodromal signs or symptoms of health crises, and many individuals experience preventable adverse outcomes.

Interactive behavior change technologies can provide a means of ongoing patient assessment between outpatient visits. Technologies such as IVR or Internet systems can be used to monitor large patient panels and identify individuals with health or self-care problems.⁴⁶ Most patients are willing and able to participate in IVR-based monitoring,⁴³ and provide valid and reliable information about their health and self-care using IVR. IVR⁴³ may be especially useful when monitoring for sensitive health problems such as alcohol abuse,⁴⁷ psychiatric comorbidity,⁴⁸ or difficulty adhering to self-care plans. Randomized trials have shown that IVR monitoring with clinician follow-up can improve self-care, perceived health status, and physiologic outcomes among individuals with diabetes⁴⁹ and hypertension.⁵⁰ Other forms of IBCT, such as the Internet, not only allow clinicians to assess patients' status between visits, but also provide a vehicle for patients to monitor and

receive feedback on changes on their own health and progress toward their self-care goals.⁵¹

Use of IBCT for Assistance and Support Between Visits

Individuals remember as little as 50% of what they are told during routine outpatient visits.⁵² Follow-up information is much more likely to be retained and understood if clinicians reinforce their educational messages and tailor those messages so that they are relevant to the individual. Patient education also is more effective when individuals have the opportunity to report their understanding of the treatment plan and participate in goal setting.⁵³ Unfortunately, these strategies rarely are used during busy outpatient encounters, and patients with the greatest need for advice or assistance (e.g., individuals with a new diagnosis or a change in treatment) are often the least likely to absorb, process, and retain key information.⁵⁴ In particular, individuals with inadequate health literacy frequently lack the knowledge or skills necessary to follow up on instructions given during outpatient visits.⁵⁵ As a result, patients with low health literacy often have worse outcomes than other patients with similar sociodemographic characteristics.^{56,57} To address these problems, many health systems rely on traditional patient education materials or didactic sessions with health educators to enhance instruction given by primary care providers. However, these strategies are not only inaccessible to many patients (e.g., those who frequently miss visits, have transportation barriers, or have language problems), but frequently are ineffective in motivating lasting behavior changes. IBCT can assist busy healthcare teams in "closing the communication loop" by checking patient comprehension of messages and providing them with permanent records of advice and plans.

Interactive behavior change technologies can also circumvent the problems associated with providing patient advice and assistance solely within the constraints of an outpatient visit. In one study, diabetes patients consistently accessed IVR-based patient education messages, and these messages were especially sought out by Spanish speakers, who frequently lacked access to language-appropriate services.⁴⁴ For the increasing number of patients with computers, e-mail is another viable and potentially effective IBCT strategy for increasing access to health information and answers to questions about self-care, medication taking, or other health concerns.⁵⁸ Internet-based interventions that include clear models of how patients can use health information, structured behavioral treatment protocols, frequent patient contact, and individualized feedback appear to be more effective than standard links to educational Websites.^{38,59}

Use of IBCT to Arrange Patient Reminders and Administrative Supports

For many patients, particularly those with multiple behavioral risk factors or chronic illnesses, medical care involves a complex array of visits with multiple clinicians, laboratory tests, and medication refills. Not surprisingly, patients frequently have difficulty adhering to these schedules. Many miss appointments, and large numbers have difficulty adhering to their medication regimen.⁶⁰ IBCTs are well suited to providing reminders. Such reminders consistently increase follow-up medical management visit adherence, as well as visits for preventive health activities.^{61,62} IVR reminders can also be used to provide ongoing support for adherence, both by reminding patients of key goals and by providing ongoing encouragement.^{63,64}

Using IBCT to Arrange Linkage to Community Resources and Peer Support

Many patients treated in primary care settings lack social support, and low social support is a risk factor for increased morbidity and mortality.⁶⁵ Both peer-to-peer⁶⁶ and clinician-led⁶⁷ group visits can increase emotional and practical support, and thereby improve outcomes. However, clinic-based support services are not accessible to everyone. Moreover, people most often seek peer support for conditions that can be socially stigmatizing (e.g., HIV or STDs, problem drinking, and obesity),⁶⁸ and even relatively anonymous face-to-face systems of peer support may be an unacceptable risk to some individuals' privacy.

Interactive behavior change technologies can extend the reach of peer support services to individuals who are unable or unwilling to participate in face-to-face interactions. Internet-based support systems are accessible and acceptable to people with a variety of health problems. One of the most frequent uses of the Internet is for information and support for specific medical conditions. One Web-based support system for mood disorders reportedly logs more than 500,000 visits annually.⁶⁹ Other studies indicate that patients are interested in using Web-based support for smoking cessation.⁷⁰ One study suggests that college-age women are open to using Internet-based discussions to discuss issues related to weight management and body image, and that such an intervention can result in healthier goals and self-perceptions.⁷¹ Although evidence of effectiveness is often lacking, some studies suggest that Internet-based support groups can improve patient satisfaction, perceptions of support, mental health, and physical symptoms.⁷²⁻⁷⁴

Discussion

The efficacy of many of the IBCT applications described above has been demonstrated by rigorous trials

in motivated clinical practices. Some of the other IBCT applications we have proposed are more visionary, although all are feasible using current technology. If established and innovative IBCT interventions to enhance prevention are to become even a partial solution to the competing demands of primary care, they must be designed in recognition of several realities of clinical practice. IBCT applications must be relevant to the preventive service issues that clinicians feel are most important and most problematic. IBCT applications should be reliable and user-friendly for clinicians and patients. To achieve this while addressing multiple health behaviors, their design must be as similar as possible across a broad range of behaviors and preventive care needs, rather than a series of stand-alone applications with unique rules, formats, and constraints.

Interactive behavior change technologies must make primary care practice more efficient by integrating counseling with the flow of clinicians' work or allowing clinicians to reallocate time spent on behavioral counseling to other essential primary care tasks. Finally, to achieve widespread adoption, IBCT innovations should be cost-neutral to practices. The income of primary care practitioners has not kept pace either with other physicians or with other professions in the United States.⁷⁵ As a result, many primary care physicians are reluctant to invest in new and costly systems.

Despite these caveats, IBCT holds substantial promise for enhancing primary care. In its 1996 report on the future of primary care, the Institute of Medicine proposed a definition of primary care as "the provision of integrated (defined as comprehensive, coordinated, and continuous), accessible healthcare services by clinicians who are accountable for addressing a large majority of personal healthcare needs, developing a sustained partnership with patients, and practicing in the context of family and community."⁷⁶ IBCT can help primary care clinicians perform many of these functions. Since it is impossible for primary care physicians to complete all the preventive care that is recommended if they personally provide it,³ or have only "1 minute for prevention,"¹ IBCT may prove essential to achieve comprehensive health behavior counseling delivery. To be effective, behavioral counseling must be coordinated and sustained. We have discussed how IBCT can extend the range of services from before the clinic visit through prolonged follow-up to monitor the process of behavior change. IBCT can substantially enhance the accessibility of behavioral counseling by ending the requirement that it occur during face-to-face physician visits.^{25,77,78}

The process of establishing productive patient-healthcare team **partnerships** can be enhanced by IBCT applications that proactively tailor counseling messages, assess the status of behavior change efforts, and identify topics for shared decision making between

patients and clinicians. IBCT applications such as Web-based assessment and tailored electronic or print feedback can be used by family members to reinforce the patient's efforts at behavior change. Finally, linkages to community resources important in the practice of community-oriented primary care, (e.g., using technologies such as global information systems that could assist in pinpointing locations of community resources such as recreation centers, grocery stores, or parks to facilitate implementation of personal behavioral goals) is a particularly exciting area. The effect of IBCT interventions on these elements of primary care, patient satisfaction, and the patient-clinician relationship should be assessed in future practical clinical trials.⁷⁹ IBCT should be used to enhance, inform, and support patient-provider interactions, not to replace them.

An office visit between patient and clinician is uniquely able to address certain patient needs: establishing trusting relationships, integrating the management of acute and chronic medical conditions with preventive services, and incorporating contextual issues from the patient's life, social network, and community into shared decisions. IBCT applications can relieve clinicians from some of the impossibly long list of behavioral counseling tasks that do not rely on their unique skills. Clinicians may be most essential in advising patients and establishing agreement, while IBCT holds particular promise in the tasks of assessment, assistance, and arranging follow-up (Table 1). In the 1 minute devoted to preventive/behavioral issues, the doctor can either "plant the seed" for IBCT to cultivate after the visit, or "reap the fruit" of IBCT interventions that have taken place prior to the visit.

Whose responsibility is it to advocate for IBCT in primary care? Increasingly, sophisticated and computer-literate patients may request it. Individual clinicians may recognize the power of these technologies and advocate for their use in their own practice microsystems.⁷⁷ The most powerful advocates for IBCT use, however, may be macrosystems such as large healthcare delivery organizations, multispecialty group practices, and payers.^{25,78} Without the assistance of these larger systems, few clinicians will be able to afford the additional technology, investigate the possible applications, or implement them in all the necessary domains. These larger systems should provide support in prioritizing, funding infrastructure, standardizing applications, and reimbursing the use of IBCTs to achieve multiple health behavior change goals. The primary incentive for systems to encourage IBCT is that they are also accountable for the provision of preventive services, through mechanisms such as Health Plan Employer Data Information Set (HEDIS) measurement, and certification by the National Committee for Quality Assurance (NCQA). For such organizations to support IBCT, however, applications will need to be scalable⁷⁸ and

able to be widely adopted and implemented (www.re-aim.org).⁸⁰

Specific areas of future IBCT research should include assessment of (1) the reach and adoption of IBCT technologies among representative patients, clinicians, and settings⁸¹; (2) the impact of IBCT on patient satisfaction and quality of life, as well as change in multiple behaviors and clinical outcomes; (3) the long-term effects, cost-effectiveness, and sustainability of IBCT programs; and (4) the characteristics of clinic systems, settings, clinicians, and patients that benefit most and least from IBCT.

For too long, we have assumed that primary care must be delivery by one clinician to one patient in one place at one time. IBCT challenges all these assumptions by augmenting the capabilities of the clinician, by reaching the patient in her/his home, and by its utility before and after the clinical encounter. Since we can no longer pretend that it is possible to deliver preventive services under the old paradigm,^{3,82} IBCT offers a rich opportunity to redefine our model for the delivery of these essential services.

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