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Application of persuasion and health behavior theories for behavior change counseling: Design of the ADAPT (Avoiding Diabetes Thru Action Plan Targeting) program

Jenny J. Lin¹ and Devin M. Mann²

¹Department of Medicine, Mount Sinai School of Medicine, New York NY, USA

²Department of Medicine, Boston University, Boston, MA, USA

Abstract

Objective—Diabetes incidence is increasing worldwide and providers often do not feel they can effectively counsel about preventive lifestyle changes. The goal of this paper is to describe the development and initial feasibility testing of the Avoiding Diabetes Thru Action Plan Targeting (ADAPT) program to enhance counseling about behavior change for patients with pre-diabetes.

Methods—Primary care providers and patients were interviewed about their perspectives on lifestyle changes to prevent diabetes. A multidisciplinary design team incorporated this data to translate elements from behavior change theories to create the ADAPT program. The ADAPT program was pilot tested to evaluate feasibility.

Results—Leveraging elements from health behavior theories and persuasion literature, the ADAPT program comprises a shared goal-setting module, implementation intentions exercise, and tailored reminders to encourage behavior change. Feasibility data demonstrate that patients were able to use the program to achieve their behavior change goals.

Conclusion—Initial findings show that the ADAPT program is feasible for helping improve primary care providers' counseling for behavior change in patients with pre-diabetes.

Practice Implications—If successful, the ADAPT program may represent an adaptable and scalable behavior change tool for providers to encourage lifestyle changes to prevent diabetes.

1. Introduction

1.1 Background

The incidence of type 2 diabetes mellitus (DM2) is increasing in the United States and Europe. Currently 26 million Americans (8% of the population) and 347 million Europeans (9.5%) have diabetes and the worldwide prevalence rate is estimated to almost double from 2.8% in 2000 to 4.4% in 2030.(1–4) Diabetes increases the risk for multiple comorbid illnesses including cardiovascular disease, renal failure, blindness and infections. Several studies have shown that DM2 can be prevented through lifestyle changes.(5) In particular,

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Corresponding author: Jenny J. Lin, MD, Associate Professor, Division of General Internal Medicine, Mount Sinai School of Medicine, 17 E 102nd Street, Box 1087, New York, NY 10029, USA, (tel) 212-824-7537, (fax) 212-831-8116, jenny.lin@mssm.edu.

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the Diabetes Prevention Program (DPP) showed that a comprehensive, intensive behavioral change program can considerably reduce progression to DM2 by 58% in people with pre-diabetes.(6) This evidence has translated into recommendations that weight control through small increases in physical activity and small reductions in caloric intake can make a significant impact on preventing diabetes.(7, 8) For clinicians, helping patients at risk for developing diabetes modify their lifestyle through effective counseling is a core function of the clinical encounter.

However, behavior change counseling efforts in primary care have shown mixed results with some trials demonstrating modest effects in increasing exercise or changing diets and others demonstrating minimal or no effect.(9, 10) Interventions that appear to be most effective in sustaining behavior changes include those that use goal-setting, physical activity prescriptions and reminders via telephone calls.(11–13) Unfortunately, the ineffectiveness of traditional counseling results in routine medical visits that inhibit effective behavior change counseling.(14) Clinicians typically spend only 1 in 20 minutes of their visit discussing treatment and planning with informed decision-making occurring in only 9% of visits.(15) This inadequate focus on patient education and counseling hinders patient understanding and internalization of information provided to them. Patients need to identify by themselves their health risks before they begin to make behavior changes.(16) The clinicians' role is to reinforce this internalization and support patients' subsequent trials at behavior change.(16) Physicians often do not know about effective behavior change techniques,(17) and often feel the time allotted for the visit is too short to effectively counsel about behavior change. Consequently, few primary care physicians (PCP) spend time discussing physical activity and lifestyle changes.(18, 19)

Recently, studies have shown that using health technologies including electronic health records (EHR), the internet or text messaging can help improve behavioral management of diabetes. (20–27) Christian et al. developed a computer program to deliver tailored self-management goal-setting prior to provider visits which patients then discussed during the visit. This approach led to increases in physical activity and weight loss.(22) Device technologies such as pedometers have also been shown to improve diabetes related behaviors.(27–30) Richardson et al demonstrated that computerized pedometer feedback significantly increased weight loss and walking among overweight high-risk patients.(27) In another study, people with diabetes assigned to a comprehensive behavior change program including a pedometer increased their steps and had significant reductions in hemoglobin A1C, weight, and body fat.

1.2 Rationale for the Avoiding Diabetes Thru Action Plan Targeting (ADAPT) program

There is clearly a gap between already-known effective behavior change interventions to prevent diabetes and PCPs' ability to actually implement them to counsel patients. We developed the ADAPT program as an attempt to address this deficit. The ADAPT program combines a streamlined shared goal-setting tool embedded in the EHR with elements derived from cognitive and non-cognitive behavior change theories to help PCPs more effectively counsel patients with pre-diabetes to improve lifestyle behaviors. We aim to describe the development and explore the feasibility of the ADAPT program.

2. Methods

2.1 Phase I: Development of the ADAPT program

Overview: An interdisciplinary team of 6 members with expertise in primary care, health psychology, diabetes education and nutrition, informatics, usability and graphic design was assembled to develop the intervention. The first step was a careful review of the behavior

change literature and an evaluation of the feasibility of behavior change counseling elements in primary care settings. Next, in-depth interviews were conducted with PCPs and patients to evaluate their attitudes towards pre-diabetes and barriers to lifestyle changes. These data were used to guide the development and refinement of a prototype of the intervention. The prototype was tested through usability studies with PCPs and further refined. Lastly, the ADAPT program underwent a feasibility study to further improve the program.

2.1.1 Theoretical basis and core concepts for intervention design—The multi-disciplinary team reviewed relevant literature about lifestyle counseling and diabetes prevention to decide upon an initial conceptual model for the intervention. Models reviewed included classical cognitive-based behavior change theories such as the Transtheoretical Model, Social Cognitive Theory, Health Belief Model and the Self-Regulation Model. (31–33) Classical behavior change models are predicated on patients being thoughtful about their decisions about behaviors and focus on changing patient cognitions towards promoting desired behavior change. Based on social cognitive theory the ADAPT program was designed to enhance patient focus on their behaviors and goals. According to the Transtheoretical Model, patients need to be actively engaged in identifying the behavior that needs to be changed in order to effect a change.(31) To leverage this principle, we incorporated questions in our pre-clinical encounter patient survey to assess behavior changes patients said they were most willing to make.

2.1.1a Goal Setting: A core component of these behavior change models is the concept of self-efficacy, and providing feedback is a critical step towards building self-efficacy.(34) Feedback delivered in a positive way helps increase self-efficacy by helping patients identify where they may be struggling and may provide suggestions or encouragement about how to overcome these challenges. One form of feedback is through tailored reminders about self-selected behavior change goals, and tailored education has been shown to improve physical activity and healthy diet changes.(35) We used these elements to create an intervention that includes frequent feedback through tailored reminders (to patient-selected goals) with self-identified action plans for behavior change.

Many successful diabetes prevention interventions, such as DPP, comprehensively integrate principles of these behavior change models to develop a multi-faceted intervention that effectively counsels lifestyle changes. However, the complexity and quantity of a program such as the DPP limit its applicability for PCP counseling. Due to time constraints of the medical visit, the expert team recommended that whatever counseling PCPs do be limited. Many interventions have incorporated setting concrete goals (also known as action plans) to help patients better achieve their desired behavior change.(36) Therefore, the element of a brief action plan was selected as the primary target of the intervention.

2.1.1b Implementation Intentions: One form of action planning that has been shown to promote successful behavior change is through the use of implementation intentions.(37–39) Implementation intentions exercises guide patients through an “if – then” scenario that encourages them to visualize potential barriers to their goal and then to generate solutions to these barriers in advance.(40) For example, if patients want to stop eating out for lunch every day, the exercise would encourage them to visualize when and where they eat out, elaborate on barriers to not going out for lunch (e.g. too rushed to make lunch) and propose their own solutions to their barriers (e.g. packing lunch the night before). We incorporated implementation intentions into the ADAPT program to help patients increase their self-efficacy toward making behavior changes.

2.1.1c Non-cognitive approaches: The multidisciplinary design team also recommended “non-cognitive” techniques that could help increase intervention efficacy. Some affective

and “non-cognitive” pathways influencing decisions about behavior as described in the Elaboration Likelihood Model (ELM) (41) were used as adjunct means to boost the cognitive-based counseling intervention. Tools that tap into “non-cognitive” pathways for behavior change include social comparisons, testimonials, reciprocity (gift giving), commitments and defaults. For example, the pharmaceutical industry has long used gifts to positively influence physician prescribing behavior(42) since gift giving often engenders feelings of reciprocity toward the gift giver (43). Use of social comparisons has also been shown to increase intention to screen for colorectal cancer(44) and improve physical activity among overweight patients (45). Based on this rationale, we designed the ADAPT program to incorporate social comparisons, reciprocity and commitments to leverage affective behavior change elements to improve cognitively-based provider counseling about behavior changes (Table 1).

2.1.1d Use of technology: Our prior work has demonstrated the ability of multidisciplinary design and EHR integration to successfully integrate evidence-based interventions into PCP workflow (22, 46, 47). Consequently, we chose to embed the ADAPT goal-setting tool within the EHR. Additionally, the design team created a patient website to reinforce the goal-setting tool from the clinical encounter. Social cognitive theory and goal-setting practice suggest that tight feedback loops where behavioral intentions and early changes are supported with direct feedback are more likely to be successful.(27, 48–53) In addition, as the typical PCP encounter is only 15–20 minutes every 3 months, the ability of the provider to provide frequent, relevant feedback about behavior goals is limited. The website can serve to provide more frequent feedback on patient-chosen goals and provide patient and provider with concrete feedback on patient progress. Further elaboration of the EHR and website components are described elsewhere.(54)

Based on these theoretical foundations and leveraging common technologies, the ADAPT program is comprised of (1) action planning through a shared goal-setting module that is embedded in the EHR and through a web-based implementation intentions exercise, and (2) feedback through web-based tailored reminders and daily pedometer use. The combination of these two main elements helps to maximize patients’ self-efficacy toward making their desired behavior changes. Furthermore, the ADAPT program leverages persuasive elements of social comparisons, testimonials and reciprocity to encourage behavior change. Lastly, the program was designed to provide many of these elements in an asynchronous longitudinal component to maintain contact with patients between physician encounters.

2.1.2 Interview strategy—To identify common behavior change goals and barriers to behavior change, twelve PCPs and eight patients who were at elevated risk for diabetes were interviewed. PCPs were interviewed about their beliefs about pre-diabetes, diabetes risk modification counseling practices, including lifestyle behavior changes, and barriers to counseling. Patients were asked about their knowledge about and risks associated with diabetes and perceived risk for developing diabetes. Patients were also asked about barriers toward making lifestyle changes and communication with their PCPs. All interviews were one-on-one, semi-structured interviews lasting 30–60 minutes and were audio-recorded and transcribed for thematic elements. The initial coding was done by one investigator and a second investigator reviewed codes for thematic congruence.

2.1.2a Provider interviews: Providers felt that diabetes was a significant problem in their patient population and estimated the prevalence of diabetes in their patient population at 20–40% (with another 30–50% at risk for developing diabetes). However, providers felt their patients who were at risk for diabetes may not understand their level of risk (“I don’t think [it] really impacts them...they don’t really see it as an active issue” [female provider in practice for 7 years]). Barriers to counseling included: lack of time, workflow disruption

(“other factors, the focus of the patient...[other] distractions” prevent discussion [female provider in practice for 14 years]), low self-efficacy (“I have very little confidence in my ability to quantify somebody’s risk” [male provider in practice for 6 years]) and low response-efficacy (“a lot of people just think ‘well, how’s that going to make such a big difference’” [female provider in practice for 14 years]). Some techniques that providers felt were useful for counseling were the use concrete examples or goals (“I usually focus on what’s the tangible, active issues so they can understand” [female provider in practice for 7 years]) and “what has worked for me is small steps that I can discuss with the patient and I am going to re-visit on the next visit” [male provider in practice for 20 years]) and motivating patients by tapping into patients’ concerns (“You just try to hook onto something that is important to them” [female provider in practice for 4 years]).

2.1.2b Patient interviews: Interviews with patients showed that most were aware of their high-risk status. Many had family members or knew friends with diabetes so knew about the types of foods to eat and diabetic complications. Patients generally believed they could prevent diabetes by making lifestyle changes (“stop eating all that sweet, that sodas, that juices” [female, 23, African-American] or “work on my weight, exercise” [female, 62, white]). They listed lack of time (“by the time you come home, you just want to lay down” [female, 44, Hispanic+), motivation (“I need that push” [female, 54, Hispanic]) and preference of unhealthy habits (“the changing completely of cooking and eating...eating what you’re supposed to, not what you really want” [female, 62, Hispanic] and “you have to change everything, your whole lifestyle” [female, 38, African-American]) as common barriers for behavior change.

2.1.3 Initial prototype—Based on literature review and interviews, the interdisciplinary team selected goal-setting as the core traditional cognitive behavior change element of the ADAPT program. To constrain the time required for counseling and to enhance the likelihood of success, the program was designed to limit the EHR-embedded goal-setting tool to 1 physical activity and 1 diet-related goal. Using responses from the interviews, a short list of preferred and commonly used goals was selected to further limit the time burden of goal-setting during the clinical encounter. For physical activity, steps per day was set as the default goal since it could be objectively measured using a pedometer (which was mailed two weeks prior to patients’ initial clinical encounter to measure their baseline steps per day). To facilitate the goal-setting conversation with providers, patients were asked to choose from a list of common activities (derived from the interviews) that they might use to achieve their goal. These activities included walking, dancing, getting off early for public transportation, and parking further away from the store. For the diet goal, the list included reducing sweetened beverages, reducing fast food consumption, using a smaller plate to decrease portion sizes, choosing lower calorie options when eating out and saving half for later. To further streamline the goal-setting during the clinical encounter, patient preferences from this list and their willingness to change their behavior were elicited using a brief survey administered by a RA and entered into the EHR goal-setting tool just *prior* to the clinical encounter.

Using principles from persuasion literature, patients were given “behavior change samples” after their visit to encourage the reciprocity mechanism for behavior change and to help build new healthy habits. For example, patients who selected using a smaller plate to reduce portion sizes were given a 9” clear glass plate to encourage them to try this new habit. Furthermore, prior to their visit, patients watched a brief pre-diabetes video that used testimonials to educate and motivate them to make changes.

To reinforce their goals, patients were encouraged to interact with the study website. Within 2 days after their visit, patients are asked to complete an implementation intention exercise

online. Then they are asked to track their pedometer steps and their pre-selected diet goal progress on a biweekly basis. Their progress is also benchmarked with other study participants to invoke the motivational potential of social comparisons. Furthermore, the information that patients input on the study website is transcribed into the EHR so providers can follow their patients' progress. Together, the pre-encounter video and goal preferences survey, encounter goal-setting tool, post-encounter behavior change samples and longitudinal website interactions comprise the initial ADAPT program prototype (Figure 1). This prototype was then subjected to extensive usability testing.

2.1.4 Usability strategy—Usability testing with providers was conducted to evaluate the EHR-embedded goal-setting tool. Using previously developed methodology(46), 7 providers used the goal-setting tool with a scripted hypothetical patient and were asked think-aloud regarding their thoughts about using the tool. The encounter was audio-recorded and screen-capture software (Hypercam) was used to observe interactions with the tool. These data were coded by two investigators and used to perform a second round of tool revisions which led to the finalized goal-setting tool. The ADAPT program was further tested by using “real-world” simulations with 6 other providers who used the revised prototype tool to counsel “near-live” simulated patient encounters (trained study staff served as simulated patients) in their usual clinic rooms.

2.1.4a Provider usability testing: Most providers liked that the EHR-embedded goal-setting tool was simple and straightforward and thought they would use it if it did not disrupt their workflow. They appreciated that the tool was “helpful to trigger those kinds of conversation, and gives you specific examples of dietary and exercise modifications.” The primary barrier was unfamiliarity with the tool. Furthermore, some screens were considered too text heavy and at times confusing. The alerting mechanism was a concern for its possible disruption of providers' usual workflow. As a result, revisions included reducing text burden and enhancing navigation simplicity. The alert system was modified to be less disruptive though this then required that providers actively seek out the goal-setting tool rather than being forced to either use it or dismiss it.

Patients who pilot tested the implementation intentions exercise thought it was straightforward to complete and were able to use the exercise to generate solutions to their self-identified barriers for lifestyle changes.

2.2 Phase II: Feasibility testing of ADAPT program

Two physicians were recruited to conduct the feasibility testing of the finalized ADAPT program. Physicians were consented and assented to have their patients with pre-diabetes contacted to participate in the study. Patients were eligible if they were English-speaking and had pre-diabetes (defined as having a glycosylated hemoglobin(A1c) level of 5.7–6.3 in the past 2 years or fasting glucose between 100 and 125). Patients who were cognitively impaired, unable to walk or who already had diabetes were excluded. Basic demographic data on physicians and patients and data on use of the ADAPT program were collected and summarized. The study was approved by the Institutional Review Board.

3. Results of Feasibility Testing

A convenience sample of two PCPs and four of their randomly-selected prediabetic patients participated in the feasibility testing. Both providers were female and had been in practice for 5–10 years. The four patients ranged from 38 to 58 years old and all were female.

At baseline, the average A1c was 5.6 and at 3 months remained at 5.6. Patients' exercise goal to increase number of steps per day ranged from 500–2000 extra steps. Two patients

chose the diet goal to “use a 9-inch plate” for meals, one chose to reduce number of sweetened beverages and one chose to eat out less often each week. Average baseline steps per day measured by the pedometer were 4284 and increased to 5250 at 3 months. Some participants who responded to the tailored reminders wrote comments about how they were doing including “I have lost five pounds” and “Sorry I didn’t really carry the meter this week. Had a tough week. I will be more focused this week.”

The providers reported that the goal-setting tool helped focus their pre-diabetes counseling and led to shorter but more effective counseling. Providers reported that using the EHR-embedded goal-setting tool took less than 5 minutes and that counseling took 5–10 minutes total. Furthermore, they noted positive reactions from their enrolled patients who appreciated the “behavior change samples” and website reinforcement.

4. Discussion and conclusion

4.1 Discussion

This paper presents the health behavior change theories and formative data underlying the development of the ADAPT program, an innovative program to improve PCP pre-diabetes counseling. The program includes a shared goal-setting tool embedded within an EHR combined with pre and post-encounter web-based longitudinal components that brings together elements of cognitive and non-cognitive psychology to increase patient self-efficacy for behavior change. While it is clear that PCPs need to be actively involved and counsel for lifestyle changes to prevent obesity and diabetes, their counseling efficacy has been limited. The ADAPT program leverages tools from behavior change theories and persuasion literature to enhance PCPs’ efficacy to counsel about lifestyle changes. The initial feasibility testing suggests that the complex components of the ADAPT program can be delivered in a seamless fashion where providers are minimally encumbered and patients successfully interact with each component: behavior change samples, website, and implementation intentions. While further testing is ongoing, this initial feasibility phase provides support for the concept of a multi-faceted technology-assisted primary care goal-setting intervention.

The DPP study showed that lifestyle changes can dramatically reduce incident diabetes but was a very resource intensive program. Past attempts of adapting the DPP to primary care have been generally unsuccessful as they attempted to compress all of the DPP components into a shorter timeframe. (55) Consequently, most successful adaptations of the DPP have occurred outside primary care settings in places such as the YMCA and use peer coaches and other non-medical facilitators.(56, 57) Incorporating all components of behavior change programs may be incompatible with primary care counseling, but key, self-limited aspects such as goal-setting and tailored feedback may be translatable elements. The ADAPT program targets these specific elements to use in a busy primary care practice to improve provider counseling about behavior change.

The ADAPT program enhances the shared goal-setting done during a clinical encounter by including an implementation intentions exercise that patients complete independently after the visit. The program also incorporates elements from persuasion literature to further boost counseling efficacy for behavior changes. Elements such as social comparisons and reciprocity were incorporated to motivate patients through “non-cognitive” or affective pathways to continue healthy behaviors. While these techniques have been extensively studied in social psychology and applied in fields such as sales and advertising, their application to medicine has been limited.(58, 59) The ADAPT program extends this initial crossover of social psychology into medicine and attempts to leverage several persuasion techniques simultaneously.

The ADAPT program also utilizes an asynchronous longitudinal component via website and emails to maintain frequent contact with patients. These frequent contacts with tailored feedback about how patients are doing with their self-selected goals help boost the chances of successful behavior change while at the same time minimizing the time and cognitive load of the intervention on providers. The use of the internet to extend the reach of the provider and encourage patient involvement and self-management is consistent with larger trends in primary care to transform the system to a patient-centered medical home.^(60, 61) The ADAPT program represents a prototype platform for technology-enhanced provider-patient interaction that boosts both patient and provider self-efficacy for successful behavior change.

Currently, a 6-month proof-of-concept pilot randomized controlled trial is underway to evaluate the preliminary efficacy of the ADAPT program on lifestyle behaviors (physical activity, diet) and clinical outcomes (A1C, weight). If successful, a large-scale efficacy trial will be conducted. Elements from ADAPT are also in further development including systems that share goal-setting and behavior change data between external interventions (commercial and academic) and the EHR.

4.2 Conclusion

The ADAPT program is the product of a unique multi-disciplinary collaboration and integrates innovative persuasive design elements grounded in behavior change theory with existing technology to improve the efficacy of provider behavior change counseling to prevent diabetes. The program is based on extensive formative development and usability testing; initial feasibility testing suggests that patients and providers find it useful. Further testing will determine whether the program is effective in improving behavior change counseling and promoting healthy lifestyle changes.

4.3 Practice Implications

If successful, the ADAPT program has significant potential to be easily scalable and disseminated among PCPs who use an EHR. Moreover, it may be possible to integrate this program with mobile platforms to deliver “in the moment” messages or with commercial behavior change systems, or to use this program in the context of social networks and social supports to enhance behavior changes. Lastly, it is well-suited to be incorporated into a medical home environment with a pre-diabetes team approach to behavior change counseling.

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References

1. CDC. Services USDoHaH. National Diabetes Fact Sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta: 2011.
2. Rosamond W, Flegal K, Friday G, Furie K, Go A, et al. Writing Group Members. Heart Disease and Stroke Statistics--2007 Update. A Report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation*. 2006; 106:1799–18.

3. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care*. 2004; 27(5):1047–53. [PubMed: 15111519]
4. Danaei G, Finucane MM, Lu Y, Singh GM, Cowan MJ, Paciorek CJ, et al. National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2.7 million participants. *Lancet*. 2011; 378(9785):31–40. [PubMed: 21705069]
5. ADA. Executive Summary: Standards of Medical Care in Diabetes 2008. *Diabetes Care*. 2008; 31(Supplement_1):S5–11.
6. Diabetes Prevention Program Research Group. Reduction in the Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin. *N Engl J Med*. 2002; 346(6):393–403. [PubMed: 11832527]
7. Hill JO, Wyatt HR, Reed GW, Peters JC. Obesity and the Environment: Where Do We Go from Here? *Science*. 2003; 299(5608):853–5. [PubMed: 12574618]
8. Craig CL, Tudor-Locke C, Bauman A. Twelve-month effects of Canada on the Move: a population-wide campaign to promote pedometer use and walking. 2007:406–13.
9. Eden KB, Orleans CT, Mulrow CD, Pender NJ, Teutsch SM. Does counseling by clinicians improve physical activity? A summary of the evidence for the U.S. Preventive Services Task Force. *Ann Intern Med*. 2002; 137(3):208–15. [PubMed: 12160371]
10. Pignone MP, Ammerman A, Fernandez L, Orleans CT, Pender N, Woolf S, et al. Counseling to promote a healthy diet in adults: a summary of the evidence for the U.S. Preventive Services Task Force. *Am J Prev Med*. 2003; 24(1):75–92. [PubMed: 12554027]
11. Ammerman AS, Lindquist CH, Lohr KN, Hersey J. The Efficacy of Behavioral Interventions to Modify Dietary Fat and Fruit and Vegetable Intake: A Review of the Evidence. *Preventive Medicine*. 2002; 35(1):25–41. [PubMed: 12079438]
12. Spink KS, Reeder B, Chad K, Wilson K, Nickel D. Examining physician counselling to promote the adoption of physical activity. *Can J Public Health*. 2008; 99(1):26–30. [PubMed: 18435386]
13. Eakin EG, Lawler SP, Vandelanotte C, Owen N. Telephone interventions for physical activity and dietary behavior change: a systematic review. *Am J Prev Med*. 2007; 32(5):419–34. [PubMed: 17478269]
14. Haire-Joshu D, Klein S. Is Primary Care Practice Equipped to Deal With Obesity?: Comment on “Preventing Weight Gain by Lifestyle Intervention in a General Practice Setting”. *Arch Intern Med*. 2011; 171(4):313–5. [PubMed: 21357806]
15. Epstein RM, Alper BS, Quill TE. Communicating Evidence for Participatory Decision Making. *Jama*. 2004; 291(19):2359–66. [PubMed: 15150208]
16. Lipkin, M., Jr; Putnam, SM.; Lazare, A. *The Medical Interview: Clinical Care, Education and Research*. New York: Springer; 1995.
17. Kushner RF. Tackling Obesity: Is Primary Care Up to the Challenge? *Arch Intern Med*. 2010; 170(2):121–3. [PubMed: 20101005]
18. Eakin E, Smith B, Bauman A. Evaluating the population health impact of physical activity interventions in primary care - Are we asking the right questions? *J Physical Activity Health*. 2005; 2:197–215.
19. Glasgow RE, Eakin EG, Fisher EB, Bacak SJ, Brownson RC. Physician advice and support for physical activity: results from a national survey. *Am J Prev Med*. 2001; 21(3):189–96. [PubMed: 11567839]
20. Holbrook A, Pullenayegum E, Thabane L, Troyan S, Foster G, Keshavjee K, et al. Shared Electronic Vascular Risk Decision Support in Primary Care: Computerization of Medical Practices for the Enhancement of Therapeutic Effectiveness (COMPETE III) Randomized Trial. *Arch Intern Med*. 2011; 171(19):1736–44. [PubMed: 22025430]
21. Hunter CM, Peterson AL, Alvarez LM, Poston WC, Brundige AR, Haddock CK, et al. Weight management using the internet a randomized controlled trial. *Am J Prev Med*. 2008; 34(2):119–26. [PubMed: 18201641]
22. Christian JG, Bessesen DH, Byers TE, Christian KK, Goldstein MG, Bock BC. Clinic-Based Support to Help Overweight Patients With Type 2 Diabetes Increase Physical Activity and Lose Weight. *Arch Intern Med*. 2008; 168(2):141–6. [PubMed: 18227359]

23. Welch G, Shayne R. Interactive behavioral technologies and diabetes self-management support: recent research findings from clinical trials. *Curr Diab Rep.* 2006; 6(2):130–6. [PubMed: 16542624]
24. Jackson CL, Batts-Turner ML, Falb MD, Yeh HC, Brancati FL, Gary TL. Computer and internet use among urban African Americans with type 2 diabetes. *J Urban Health.* 2005; 82(4):575–83. [PubMed: 16221917]
25. Dick JJ, Nundy S, Solomon MC, Bishop KN, Chin MH, Peek ME. Feasibility and usability of a text message-based program for diabetes self-management in an urban African-American population. *J Diabetes Sci Technol.* 2011; 5(5):1246–54. [PubMed: 22027326]
26. Franklin VL, Waller A, Pagliari C, Greene SA. A randomized controlled trial of Sweet Talk, a text-messaging system to support young people with diabetes. *Diabet Med.* 2006; 23(12):1332–8. [PubMed: 17116184]
27. Richardson CR, Brown BB, Foley S, Dial KS, Lowery JC. Feasibility of adding enhanced pedometer feedback to nutritional counseling for weight loss. *J Med Internet Res.* 2005; 7(5):e56. [PubMed: 16403720]
28. Yates T, Davies M, Gorely T, Bull F, Khunti K. Effectiveness of a Pragmatic Education Program Designed to Promote Walking Activity in Individuals With Impaired Glucose Tolerance. *Diabetes Care.* 2009; 32(8):1404–10. [PubMed: 19602539]
29. Diedrich A, Munroe DJ, Romano M. Promoting Physical Activity for Persons With Diabetes. *The Diabetes Educator.* 2009;0145721709352382.
30. Booth AO, Nowson CA, Matters H. Evaluation of an interactive, Internet-based weight loss program: a pilot study. *Health Educ Res.* 2008; 23(3):371–81. [PubMed: 18349032]
31. Prochaska JO, Velicer WF. The transtheoretical model of health behavior change. *Am J Health Promo.* 1997; 12:38–48.
32. Glanz, K.; Rimer, B.; Viswanath, K., editors. *Health Behavior and Health Education.* 4. San Francisco: Jossey-Bass; 2008.
33. Leventhal, H.; Brissette, I.; Leventhal, E. *The common sense models of self-regulation of health and illness.* London: Taylor & Francis Books, Ltd; 2003.
34. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev.* 1977; 84(2):191–215. [PubMed: 847061]
35. Kroeze W, Werkman A, Brug J. A systematic review of randomized trials on the effectiveness of computer-tailored education on physical activity and dietary behaviors. *Ann Behav Med.* 2006; 31(3):205–23. [PubMed: 16700634]
36. Bodenheimer T, Handley MA. Goal-setting for behavior change in primary care: An exploration and status report. *Patient education and counseling.* 2009; 76(2):174–80. [PubMed: 19560895]
37. Gollwitzer, PM.; Sheeran, P. *Advances in Experimental Social Psychology.* San Diego, CA: Elsevier Academic Press; 2006. Implementation intentions and goal achievement: A meta-analysis of effects and processes; p. 69-119.
38. Guillaumie L, Godin G, Manderscheid JC, Spitz E, Muller L. The impact of self-efficacy and implementation intentions-based interventions on fruit and vegetable intake among adults. *Psychol Health.* 2012; 27(1):30–50. [PubMed: 21678169]
39. Arbour KP, Martin Ginis KA. A randomised controlled trial of the effects of implementation intentions on women's walking behaviour. *Psychol Health.* 2009; 24(1):49–65. [PubMed: 20186639]
40. Webb TL, Sheeran P. Mechanisms of implementation intention effects: the role of goal intentions, self-efficacy, and accessibility of plan components. *Br J Soc Psychol.* 2008; 47(Pt 3):373–95. [PubMed: 18096108]
41. Petty R, Cacioppo J. The elaboration likelihood model of persuasion. *Adv Exp Soc Psych.* 1986; 19:124–192.
42. Wazana A. Physicians and the pharmaceutical industry: is a gift ever just a gift? *Jama.* 2000; 283(3):373–80. [PubMed: 10647801]
43. Shen H, Wan F, Wyer RS Jr. Cross-cultural differences in the refusal to accept a small gift: the differential influence of reciprocity norms on Asians and North Americans. *J Pers Soc Psychol.* 2011; 100(2):271–81. [PubMed: 21058870]

44. Lipkus IM, Klein WM. Effects of communicating social comparison information on risk perceptions for colorectal cancer. *J Health Commun.* 2006; 11(4):391–407. [PubMed: 16720537]
45. Belanger-Gravel A, Godin G, Vezina-Im LA, Amireault S, Poirier P. The effect of theory-based interventions on physical activity participation among overweight/obese individuals: a systematic review. *Obes Rev.* 2011; 12(6):430–9. [PubMed: 20331511]
46. Mann DM, Kannry JL, Edonyabo D, Li AC, Arciniega J, Stulman J, et al. Rationale, design, and implementation protocol of an electronic health record integrated clinical prediction rule (iCPR) randomized trial in primary care. *Implement Sci.* 2011; 6(1):109. [PubMed: 21929769]
47. Li A, Kushniruk A, JLK, Chrimes D, McGinn T, DE, et al. Integrating usability testing and think-aloud protocol analysis with “near-live” clinical simulations in evaluating clinical decision support. *Int J Med Inform.* 2012 (in press).
48. Mugford M, Banfield P, O’Hanlon M. Effects of feedback of information on clinical practice: a review. *Bmj.* 1991; 303(6799):398–402. [PubMed: 1912809]
49. Spring B, Schneider K, McFadden H, Vaughn J, Kozak A, Smith M, et al. Make Better Choices (MBC): Study design of a randomized controlled trial testing optimal technology-supported change in multiple diet and physical activity risk behaviors. *BMC Public Health.* 2010; 10(1):586. [PubMed: 20920275]
50. McAndrew LM, Musumeci-Szabo TJ, Mora PA, Vileikyte L, Burns E, Halm EA, et al. Using the common sense model to design interventions for the prevention and management of chronic illness threats: from description to process. *Br J Health Psychol.* 2008; 13(Pt 2):195–204. [PubMed: 18331667]
51. Hurling R, Catt M, Boni MD, Fairley BW, Hurst T, Murray P, et al. Using internet and mobile phone technology to deliver an automated physical activity program: randomized controlled trial. *J Med Internet Res.* 2007; 9(2):e7. [PubMed: 17478409]
52. Tate DF, Jackvony EH, Wing RR. Effects of Internet Behavioral Counseling on Weight Loss in Adults at Risk for Type 2 Diabetes: A Randomized Trial. *JAMA.* 2003; 289(14):1833–6. [PubMed: 12684363]
53. Bennett JW, Glasziou PP. Computerised reminders and feedback in medication management: a systematic review of randomised controlled trials. *Med J Aust.* 2003; 178(5):217–22. [PubMed: 12603185]
54. Mann DM, Lin JJ. Increasing efficacy of primary care-based counseling for diabetes prevention: rationale and design of the ADAPT (Avoiding Diabetes Thru Action Plan Targeting) trial. *Implement Sci.* 2012; 7:6. [PubMed: 22269066]
55. Whittemore R, Melkus G, Wagner J, Dziura J, Northrup V, Grey M. Translating the diabetes prevention program to primary care: a pilot study. *Nurs Res.* 2009; 58(1):2–12. [PubMed: 19092550]
56. Ackermann RT, Finch EA, Brizendine E, Zhou H, Marrero DG. Translating the Diabetes Prevention Program into the community. The DEPLOY Pilot Study. *Am J Prev Med.* 2008; 35(4):357–63. [PubMed: 18779029]
57. Jackson L. Translating the Diabetes Prevention Program Into Practice: A Review of Community Interventions. *The Diabetes Educator.* 2009; 35(2):309–20. [PubMed: 19321809]
58. Cialdini RB, Goldstein NJ. Social influence: compliance and conformity. *Annu Rev Psychol.* 2004; 55:591–621. [PubMed: 14744228]
59. Cialdini, RB. *Influence: The Psychology of Persuasion.* HarperCollins; 2006.
60. Wagner EH, Austin BT, Davis C, Hindmarsh M, Schaefer J, Bonomi A. Improving Chronic Illness Care: Translating Evidence Into Action. *Health Aff (Millwood).* 2001; 20(6):64–78. [PubMed: 11816692]
61. Kilo CM, Wasson JH. Practice Redesign And The Patient-Centered Medical Home: History, Promises, And Challenges. *Health Affairs.* 2010; 29(5):773–8. [PubMed: 20439860]

Figure 1.
ADAPT program

Table 1

Components of the ADAPT program

Component	Medium of delivery	Main aim	Theoretical underpinnings
Goal-setting tool	Electronic health record	Self-identify behavior change goals and negotiated in shared decision making process with provider Goal options prepopulated for patient and provider	Self-efficacy and self- regulation Defaults
Implementation intentions exercise	Patient website	Increase self-efficacy to identify barriers and create solutions to overcome barriers to achieving behavior goals	Self-efficacy and self- regulation
Behavior change prescription	During patient visit in clinic	Obtain verbal and written commitment to behavior change goal	Commitment and Consistency
Social comparisons	Patient website	Compare how others in the study are doing relative to self	Perceived norms (social proof/ conformity)
Behavior change samples	During patient visit in clinic	Give free samples to encourage behavior change and engender reciprocity towards gift-giver Provider gives pedometer	Reciprocity and Facilitation Authority
Testimonials	Prior to patient visit in clinic	Learn about pre-diabetes and healthy lifestyle behaviors through peer modeling	Observational learning (Social Cognitive Theory) & Perceived norms
Web and email- based frequent tailored reminders	Patient website	Controlling behavior through feedback about behavior change goal and encouragement and suggestions for how to improve	Self-regulation (Social Cognitive Theory)