

TXT ME; IT to change teen health risk behaviors

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Abstract

Purpose: To develop and implement point of care and post visit IT supports that activate adolescents to change exercise and change daily exercise.

Scope: Little is known about the impact of clinician counseling about exercise in adolescents. Technology can assist the clinician both to determine teen readiness to change exercise and prompt the clinician to counsel. After the visit, text messaging can be used to support change.

Methods: Adolescents screened for health risks at preventive visits, if interested in changing exercise, were sequentially enrolled in control or intervention. The intervention group had clinician IT prompting to counsel and 6-7 weeks of text messaging. Data was collected via the screener (T0), 4-6 weeks after the visit(T1) and 12 weeks later(T2).

Results: Clinician discussion was a predictor of both sustained effort to try to increase exercise at T1 and having started new kinds of exercise at T1. Increased exercise was also predicted by BMI $\geq 95\%$, perceived stress and importance of exercise. After the T1 survey 86 percent were assessed at T2 to determine change in minutes of exercise in the past 24 hours from (T2-T1). Intervention status was a significant predictor with 48 minute (adjusted mean) increase in exercise compared to control.

Key words; exercise, primary care, adolescence, obesity

Purpose

1) Develop the TXT ME information technology intervention to enhance adolescent exercise behaviors. It consists of three components: a) clinician prompts to support effective motivational counseling for exercise with an adolescent health risk screener on a handheld computer, b) a program of automated text messages to support adolescents increasing daily aerobic exercise, and c) internet based supports and resources supporting change.

2) Conduct a feasibility trial of the TXT ME model that will provide health risk screening using PDA technology to screen and prompt clinicians, and provide via post-visit IT reinforcement to make changes when teen indicates interest in changing exercise. Evaluation will include short term outcomes related to message design and health behavior outcomes.

Scope

Background

Health Information technology is more commonly thought to involve health professionals and medical record systems. Consumer use of information technology to enhance health is a rapidly emerging area. While developing countries may use cell phones more widely to influence health, within the United States new approaches to change health behavior via text messaging have been introduced over the past few years. While delivery of text messages to educate, remind and motivate patients has occurred in research settings and is being introduced nationally with pregnant women and new mothers (Text4baby) there has been little work integrating counseling by clinicians with subsequent text messages to support behavior change. Rather use of cellular phones has varied from highly interactive coaching delivered in person or by automated programs to simple reminders (e.g. Immunizations, take birth control pills). This study was conducted during this rapidly evolving period.

Physical activity outside of weight management programs has not been addressed in most text message initiations. Unfortunately as adolescence progresses there are more sedentary activities (e.g. television, video and internet use) and less physical activity. Among 12th graders, 28.9% didn't participate in 60 minutes or more of physical activity on any day, compared to 21.5% of 9th graders²². Physical activity habits established in adolescence persist well into adulthood²³. Inadequate physical activity is linked to other health risks of poor nutrition and excess screen time²⁴. In addition changing physical activity has other potential positive benefits that include weight reduction, positive mood and self-image. Thus a potential cascade of changing multiple health behaviors is possible when teens begin to increase their physical activity. Thus, enhancing clinician counseling and increasing adolescent efforts to exercise was selected as the focus of this study.

Our goal was to integrate the use of point of care information technology (screening via handheld computers) with a text message based intervention to reinforce the initial change efforts after the clinician's counseling. The screening informs the primary care clinician of teen risks and about teens' readiness to change their exercise. In

addition at the intervention stage the clinician reports at screening with also provide Clinician motivation interviewing based counseling tips specific to that teen's motivational state.

Context and participants

The Text Me study was conducted in 7 practices of the Clinicians Enhancing Child Health primary care practice based research network located in Vermont and New Hampshire. Five of the seven practices are located in rural or small town communities. Ninety percent or more population in these practices is white and all practices accept Medicaid patients.

Participants were recruited from adolescents grade 9 or higher that indicated during their electronic health risk screening at their preventive health visit that they were interested in exercising more. These adolescents indicated interest in the study by leaving their contact information. They received a telephone call to learn more about the study and complete the consent process if willing to participate.

Methods

Study Design

Two populations of adolescents were sequentially recruited to participate because clinician supports at the practice level were introduced that did not allow randomization. The first cohort was the control group. Prior to recruitment of the intervention at the practice level changes were introduced to provide enhanced screening with prompts to counsel about exercise tailored to the adolescent's reported importance and confidence levels. Intervention subjects were evaluated at 4-6 weeks post visit prior to text messages being provided for 7 weeks. Four weeks after completion of the text messaging adolescents were surveyed.

Text messaging

Messages were developed within a framework positive messaging by the investigator and a team of college level research assistants. An advisory group of local high school teens reviewed and provided input into the final messages. Initially the intent had been to provide access to exercise related Internet content via the cell phone. However during development because many adolescents did not have data plan text messages gave sites to access later on the Internet. Feedback from the advisory group testing the messages led to a weekly summary of the exercise options from the Internet sent via text to also be sent to participants as an email. Qualitative feedback from students guided the content and timing of messages. While a variety of types of exercise and options for exercise to be fun were included, incorporation of small periods of aerobic exercise that they could do on their own throughout the day and steadily build the time spent was key to the messages.

The messages progressively moved from starting to exercise, putting small amounts into everyday, then increasing the time and intensity of exercise routine. Along with this having fun, exercising with friends was included. During weeks two and three when building up exercise plan messages were specific to males or females. By 6 weeks the messages supported having a personalized 30-minute exercise plan that could be

incorporated into their day as well as having fun exercising with friends. The last week emphasized reviewing progress and how to maintain the exercise changes they had made. Sample messages and the weekly message themes are included in table 1. Eight of the messages addressed healthy eating strategies as a complement to exercise.

Text message delivery

Utilizing email to text conversion software an automated delivery of text message to cell phones occurred based on date of the first survey completion occurred. All subjects received 7 weeks of messaging. Three to 4 message/day were provided for a total of 167 messages over 7 weeks. Messages were planned to not occur during school and were provided at 7:30 AM, 3pm, 5pm, and 9 pm because they transition points during the day where adolescent could plan to do exercise. Adolescents could access exercise demonstration videos mentioned in the messages at the TxtMe web site and received all of them once weekly by email.

At 2 weeks all subjects received a cell phone message asking if in the prior two weeks asking if they had increased their exercise in the prior two weeks. If they said no, or did not respond, they received an additional week of messages focused on starting to exercise before receiving the next 5 weeks of messages.

Measures

At the office visit (T0) via the screener and at the post-visit survey (T1), adolescents answered questions about exercise; Are you interested in being more active or exercising more at this time (Y/N), How important is it to you to exercise more at this time (0-10 response), and How confident are you that you could exercise more at this time (0-10 response). In addition at T1 asked for weight and height and, Did you talk with your health provider about ways to be more active or exercise more (Y/N/ Don't remember) . If discussed asked, how helpful was the discussion (Very/Somewhat/ Not Helpful). Two questions at T1 assessed changes in exercise since their health visit; Since your visit have you tried to increase your Exercise (yes, tried and am still doing it/ yes tried but not still doing it/No), and Have you started to do any new types of physical activity (Y/N). Future intent was assessed with the question, Do you plan to make any changes in the amount you exercise in the next month (Y/N/Maybe). Sustained effort to try to increase exercise was determined by collapsing the responses to yes tried and still doing it vs. no/ yes tried but no longer doing it. At T1 and T2 (12 weeks post intervention) perceived stress was determined by asking In the past month have you felt stress or pressure at school, at home, in your social life on a 0-3 scale (none/some/ most the time/all the time). This was summed for a scale ranging from 0-9. Self-report of exercise was determined with the question, In the past 24 hours how many minutes did you exercise or do other vigorous exercise. This was asked at T1 and T2. The difference from T1 to T2 was calculated for the outcome variable of change in exercise. Season of the year was calculated from date of survey (Sept-Nov, etc.). Additional survey items assessed perceived support for exercise from others, pro and anti-exercise attitude, access to sporting equipment and facilities and view of teens who exercise., Because they did not differ between intervention or control at T1 or T2 , they are not included in this report.

Results

The study examined outcomes at two stages. The first looked at the impact 4-6 weeks of clinician counseling on activating teens to exercising more. This assessment of post-visit change was prior to delivery of the texting intervention. The second stage looked at changes in youth self reported exercise 12 weeks (T3) after the survey done at 4-6 weeks(T0). This was 4 weeks after the intervention group had received 7 weeks of text messaging and associated emails and access to the project's network site.

Study One: Predictors of adolescent initial change exercise after the health visit

The subject recruitment and retention is shown in Figure 1. The characteristics of the initial study population of 206 are described in Table 2. The proportion with BMI >95% is the same as the NH state-wide average of high school students. Table 3 shows the role of these adolescent characteristics and motivational status and clinician discussion in motivating adolescents to exercise more. Clinician discussion appeared to be a catalyst for teens interested in exercising more to take action in both making a continued effort to exercise more and to start new kinds of exercise. A key motivational factor, perceived importance of exercising more influenced only efforts to exercise more, not initiation of new kinds of exercise. Their level of confidence that they could change their exercise did not play a role. Stress level at 4-6 weeks, not initially, had a negative influence on youth sustaining their effort to change behavior.

The only significant predictor in the adjusted logistic regression model of whether teens planned to change their exercise in the next month following the survey was age where for OR of 1.2 (1.02-1.53 95th CI) indicated that for every year older they were 20% more likely to plan to change exercise.

Study Two: Impact of text messages on exercise levels

The impact of text messages on exercise was assessed by follow up survey at T2 with the outcome variable of change in self-reported exercise in the last 24 hours from T1 to T2 which is 4 weeks after text messaging was completed. The subject recruitment and retention is shown in Figure 1. From T1 to T2 there was 9% attrition in the controls and 20% in the intervention group. There was no significant difference in retention between teens in the intervention that required additional messaging because of not starting to make exercise changes in the first 2 weeks of the intervention (relapse group) and others.

The overall ANCOVA model for predicting change in past 24 hour exercise after 12 weeks was significant ($p = .039$) controlling for covariates of practice site and season of the year at both T1 and T2. There was a significant effect of group status favoring intervention group ($p = .019$). The variables that differed significantly between intervention and control groups (BMI and perceived stress) were not significant predictors. However, there was a significant interaction between BMI >95% status and group ($p = .048$) such adolescents who were overweight improved more in the intervention group. The adjusted mean change of minutes of exercise from T1 to T2 is provided in table 4. The mean is controlled for the significant variation in season at onset and later assessment and the perceived stress when exercise change being assessed. There was 48 more minutes in the control group with effect being found among obese teens in the intervention group.

In addition to the intervention being more effective for obese adolescents, the intervention appeared to have more appeal to obese adolescents enrolled at nearly twice the rate than for the earlier controls (Table 4). However, at the clinician level the prompts appeared to have increased the likelihood that they would talk to all teens about exercising more. For controls the health provider discussed exercise with 75% (9/12) obese teens but only 33% (30/90) of non-obese teens ($p < .01$). During the intervention they discussed exercise at similar rates for both obese teens and non-obese teens (Obese 67%, 12/18; Non-obese 53%, 30/57, $p = .42$). However, clinician discussion substituted for intervention status was not a significant predictor of change in exercise 4-5 months(T2) after the visit.

After the final surveys were completed, 19 of the 75 intervention subjects were randomly selected and interviewed by phone to evaluate their experience. The program was well received. For the majority the qualitative responses have been shared earlier in AHRQ reports. All 19 would recommend this program to a friend.

Limitations

This is a small study conducted in a predominately white population in New England. Further study needs to occur in more ethnically and racially diverse settings. It tells us what influences teens to take action when they express interest in exercising more, not when adolescents have no interest in change. This represents about half the adolescents seen in the primary care settings. Other types of interventions will be needed to motivate teens with no interest in changing behavior.

We have carefully tracked the steps between initial interest when given a brief introduction to the study and consent. It is challenging to recruit adolescents in primary care settings with about a third the students who were initially interested being willing to be part of the study when they learned about surveys to complete or the intervention. While consenting by phone was the most feasible way to conduct the study in dispersed primary care practices, being unable to reach both adolescent and parent, after repeated phone calls occurred in a third of eligible participants. The attrition rate was greater in the intervention group (20%) than controls (9%) that was primarily due to not being able to reach intervention subjects in the summer with vacations, not using their email that is linked to the school.

Our study uses self-report, not observation that can introduce bias. In several studies adolescent self-report has been used to determine clinician counseling behavior. Reports on exercise in the prior 24 hours as the most immediate event to be remembered. In an attempt to reduce bias we assessed exercise in the past 24 hours at several points, and examined change, not the final number of minutes of exercise reported. Youth reporting at T2 would not know earlier numbers. However, these results that indicate exercise change should be confirmed in the future with direct measurement of activity.

Conclusions

This study first informs us both about what influences adolescents to try to increase their exercise and try new types of exercise when they indicate a readiness to change. We

have shown that clinician discussion is an important catalyst for change that can activate teens to exercise more and try new exercise. However for longer term change further intervention is needed. The text messaging intervention appears to be effective at increasing exercise 4 weeks after its conclusion in this small study.

Adolescence is an important time period where adolescents are establishing health practices. Utilizing information technology to both enhance the screening and counseling by clinician linked to post visit support using a common technology, text messages, to support changes in daily exercise, offers promise as an integrated approach to enhancing adolescent exercise habits.

Table 1. Text Message Examples

Weekly Theme	Day/Time	Message
Week 1: Setting Goals and Anticipating Obstacles	Tuesday 7:30 AM	Why is exercise important 2 u? Lots of teens exercise 4 a mood lift. Write down 1 reason why u want 2 exercise 2day & keep it in yr pocket.
	Tuesday 3:00 PM	Remember your reason to exercise? Set aside 10-30 minutes today to exercise & do it with TV or music.
	Tuesday 5:00 PM	It's time 2 exercise! Start by stretching; then do 3 sets of 15 jumping jacks. Take break 2 rest in between; after do 2 sets of 10 !
	Tuesday 9:00 PM	Awesome! U made some big steps today towards being healthier. Look back @ yr reason to exercise. Feel proud! U are on the right track!
Week 2: Introduction to Strength Training	Saturday 7:30 AM	No equipment? Use this centuries-old exercise--jumping rope! Find a rope or a cord around house (or buy one cheap) and jump rope for 10-15 minutes today.
	Saturday 3:00 PM	Pro athletes say jump roping improves their coordination, balance & agility--plus cardio! Burns fat and tones arms, legs, and stomach.
	Saturday 5:00 PM	Jump rope is a serious workout! In 10-15mins you can burn 200 calories--same as an hour of bowling! Jumping rope will get yr whole body in better shape.
	Saturday 9:00 PM	Remember that not having equipment isn't an excuse 2 not be active! Any type of rope can substitute 4 a jump rope or u can do jumps over a line.
Week 3: More Targeted Workouts		
Week 4: Amping up the exercise		
Week 5: Motivation and Technique		
Week 6: Exercise, Energy and Eating		
Week 7: Maintenance	Monday 7:30 AM	Be proud of choosing 2 b more active. Maybe it was a little hard, but u can stick with it. Make a plan 2 keep it up w/out the daily texts.
	Saturday 3:00 PM	What is your favorite exercise? Write down what exercises to do each day except on one break day. Remember to have fun. :)
	Saturday 5:00 PM	Making a workout routine is just like making a music playlist. Mix it up from time to time to keep things interesting.
	Saturday 9:00 PM	Have u made a activity plan for this week? If not, get to it! U have total freedom in choosing what u do. Try different things each day!

Table 2. Study One Population characteristics

	N=206
<i>Assessed at pre- health visit screening</i>	
Age in years (range 14-19): mean \pm SD	15.5 \pm 1.7
Sex; female	139 (67.5%)
Interested in exercising more; yes	206 (100%)
Importance to exercise more (1-10): mean \pm SD	7.42 \pm 2.2
Confidence can exercise more (1-10): mean \pm SD	7.40 \pm 2.4
BMI \geq 95%	35 (17%)
<i>Assessed at follow up survey at 4-6 weeks</i>	
Stress (range 0-9)	2.20 \pm 1.9
Discuss with clinician ways to be more active or exercise more	92 (44.7%)
Sustained effort to increase exercise since visit	127 (61.4%)
Started new kinds of exercise since visit	78 (62.1%)
Plan to make any changes in the Amount of exercise in the next month	142 (68.9%)
Recruited to intervention participation	93 (45.1%)

Table 3. Predictors of adolescent changes in exercise behaviors one month after health visit+

	Sustained effort to exercise more since health visit		Started new kinds of exercise since health visit	
	Unadj. OR (95 th CI)	Adj. OR (95 th CI)	Unadj. OR (95 th CI)	Adj. OR (95 th CI)
Age	.90 (.77-1.07)	.89 (.74-1.08)	.88 (.74-1.04)	.84 (.70-1.01)
Importance to exercise more	1.16* (1.02-1.33)	1.21* (1.02-1.45)	1.04 (.91-1.18)	1.07 (.90-1.26)
Confidence can exercise more	1.03 (.91-1.16)	.92 (.78-1.09)	1.03 (.91-1.16)	1.0 (.85-1.16)
Stress	.90 (.78-1.04)	.84 * (.71-.99)	1.06 (.91-1.22)	1.08 (.91-1.28)
BMI \geq 95%	4.57** (1.7-12.3)	3.06 * (1.06-8.80)	.61 (.27-1.34)	.49 (.21-1.18)
Clinician discussed exercise	2.90*** (1.60-5.27)	2.53** (1.31-4.89)	2.16** (1.22-3.83)	2.76** (1.47-5.21)

Sex, practice site, and recruitment to the intervention status were all non-significant in the model and not included in this table.

* < p<.05, **p<.01 *** p<.001

Table 4. Study two: Intervention study population characteristics

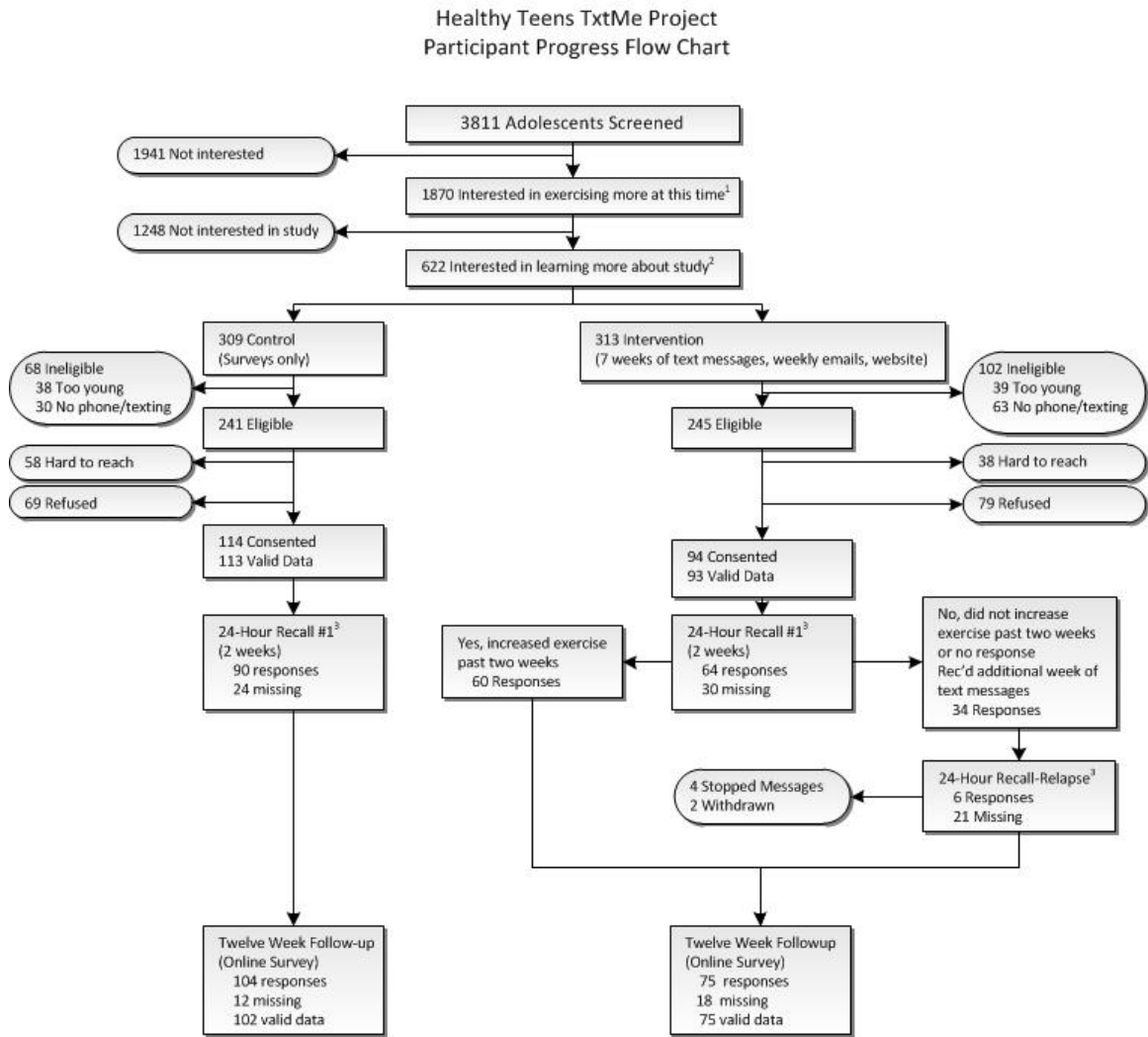
Characteristic	Control N=102	Intervention N=75	P value
Sex			.16
Female	66 (64.7%)	56 (74.7%)	
Male	36 (35.3%)	19 (25.3%)	
Age in years (mean SD)	15.37 (1.6)	15.43 (1.8)	.84
Grade			.84
9 th	19 (18.6%)	18 (24.0 %)	
10 th	18 (17.6%)	12 (16.0%)	
11 th	24 (23.5%)	14 (18.7%)	
12 th	15 (14.7%)	13 (17.3%)	
College	12 (11.8%)	6 (8.0%)	
Not in School	14 (13.7%)	12 (16.0%)	
BMI			.03
<95%	90 (88.2%)	57 (76%)	
≥ 95%	12 (11.2%)	18 (24.0%)	
Season at baseline			p< .001
Spring	0	27 (36.0%)	
Summer	27 (26.5%)	0	
Fall	58(56.9%)	0	
Winter	17 (16.7%)	48 (64%)	
Season at 12 weeks			p< .001
Spring	13 (24.5%)	40 (53.3%)	
Summer	1 (3.1%)	31 (41.3%)	
Fall	21 (20%)	0	
Winter	67 (65.7%)	4 (5.3%)	
Perceived Stress @ T1 Range 0-9 (mean ±SD)	2.11 (1.7)	2.47 (2.2)	.23
Perceived Stress @ T2 Range 0-9 (mean ±SD)	6.28 (2.3)	5.52 (2.4)	.04

Table 3. Study two: Adjusted change in minutes of exercise reported in the prior 24 hours after 12 weeks in intervention vs. control sites

Group	Weight status	Adjusted* Mean (Minutes)	SE	95 th % Confidence Interval
Control	All weights	-6.10	14.5	-34.87 to 22.67
	BMI <95%	+6.01	11.93	-17.56 to 29.59
	BMI ≥95%	-21.67	27.68	-76.39 to 33.06
Intervention	All weights	+42.7	15.1	12.89 to 72.54
	BMI <95%	+25.97	16.97	-7.58 to 59.52
	BMI ≥95%	+76.21	24,55	27.67 to 124.74

* Model is adjusted for practice site, season at T1 and season at T3

Figure 1. Participant recruitment and retention



1. Question: "Are you interested in getting more exercise at this time?" (Yes/No)
2. Question: "Would you like to be contacted with more information about a research study on exercise?" (Enter contact information)
3. Question: "In the past 2 weeks, have u tried to increase yr exercise (yes or no)? In the past 24hrs, how many min did u exercise or do other vigorous activity?" (Open-ended reply via text message)

Appendix 1: Smoking behaviors

Initially smoking had also been included in the screener and message development portion of the project but not the clinical trial. However in the first year 2 major groups presented studies at the NIH mobile health national conference on smoking cessation text messages already developed for youth. These programs were fully functional and in the process of implementation at Georgetown and in New Zealand. Prompts for smoking cessation counseling had already been developed. Because of this data was collected from adolescents about interest in quitting smoking, and motivational status (importance and confidence can reduce smoking) needed to determine which youth screened in primary care would be appropriate to deliver messages to.

Among the 3800 adolescents screened we learned that N (7%) were current smokers (in the past month). Among these smokers 47% indicated to their clinicians they were interested in changing their smoking. Among youth who were interested in changing 75 % expressed changing as high importance (7-10 on 10 point scale) and 60% had high confidence they could change their smoking. 24% of adolescents stated changing their smoking was of both high importance and high confidence. This is the group according to motivational theory is ready to make a change and are appropriate to support post visit. In contrast only 2% who were not interested in making a change in their tobacco use were high on both importance and confidence.