Published in final edited form as:

J Dual Diagn. 2015 ; 11(2): 145–150. doi:10.1080/15504263.2015.1025025.

Factors Influencing Implementation of Smoking Cessation Treatment within Community Mental Health Centers

Clayton H. Brown, PhD^{1,3}, Deborah Medoff, Ph.D^{2,3}, Faith B. Dickerson, PhD, MPH⁴, Li Juan Fang, MS^{2,3}, Alicia Lucksted, PhD^{2,3}, Richard W. Goldberg, PhD^{2,3}, Julie Kreyenbuhl, Pharm.D., PhD^{2,3}, Seth Himelhoch, MD, MPH^{2,3}, and Lisa B. Dixon, MD, MPH⁵

Clayton H. Brown: cbrown@epi.umaryland.edu; Deborah Medoff: dmedoff@psych.umaryland.edu; Faith B. Dickerson: fdickerson@sheppardpratt.org; Li Juan Fang: lfang@psych.umaryland.edu; Alicia Lucksted: aluckste@psych.umaryland.edu; Richard W. Goldberg: Richard.Goldberg@va.gov; Julie Kreyenbuhl: jkreyenb@psych.umaryland.edu; Seth Himelhoch: shimelhoch@psych.umaryland.edu; Lisa B. Dixon: dixonli@nyspi.columbia.edu

¹University of Maryland School of Medicine, Department of Epidemiology and Public Health, Baltimore, Maryland ²University of Maryland School of Medicine, Department of Psychiatry, Baltimore, Maryland ³VA Capitol Health Care Network Mental Illness Research Education and Clinical Center, Baltimore, Maryland ⁴Sheppard Pratt Health System, Baltimore, Maryland ⁵New York State Psychiatric Institute, and Department of Psychiatry, College of Physicians and Surgeons, Columbia University, New York, New York

Abstract

Objective—Consumers with serious mental illness smoke more and are at higher risk for smoking-related illness. We examined provider and consumer factors influencing the implementation of the evidenced based “5A’s” (Ask, Advise, Assess, Assist, Arrange) in six community mental health centers in greater Baltimore.

Methods—Data collected as part of a larger study examining the effectiveness of delivery of the 5A’s at patient visits. First, we examined responses to a survey administered to 49 clinicians on barriers and attitudes toward delivering the 5A’s. Second, we used multilevel models to examine variance between patients ($n=228$), patient factors, and variance between their psychiatrists ($n=28$) in the delivery of the 5A’s (and first 3 A’s).

Results—The most strongly endorsed barrier was perceived lack of patient interest in smoking cessation. Psychiatrists and patients both accounted for significant variance in the delivery of the 5A’s and 3A’s. Patient “readiness to change” predicted delivery of the full 5A’s, while smoking severity predicted delivery of the first 3 A’s.

Conclusions—There is a critical need for creative and collaborative solutions, policies, and clinician training to address actual and perceived obstacles to the delivery of evidenced-based smoking cessation treatment in the mental health care setting.

Address correspondence to: Lisa Dixon, M.D., New York State Psychiatric Institute, Room 2702, Box 100, 1051 Riverside Drive, New York, NY 10032.

DISCLOSURES

The authors report no financial relationships with commercial interests with regard to this manuscript.

Keywords

serious mental illness; smoking cessation; barriers to treatment; implementation research

Smoking is the leading cause of preventable mortality in the United States. Smoking contributes to increased rates of lung cancer, heart disease and other illnesses, and adds dangerous complications to health problems such as diabetes and obesity (U.S. Department of Health and Human Services, 2004; Godtfredsen, Prescott, & Osler, 2005). As many as 70% of people diagnosed with schizophrenia, bipolar disorder and other serious mental illnesses smoke cigarettes, greatly exceeding the general adult population prevalence of less than 20% (de Leon & Diaz, 2005; CDC, 2008; Lasser et al., 2000). These extraordinary rates of smoking contribute to elevated morbidity and mortality among people diagnosed with serious mental illness and increased health care costs (Waxmonsky et al., 2005; Himelhoch, et al., 2004; Addington, J., el-Guebaly, N., Campbell, W., Hodgins, D.C., & Addington, D., 1998). Treating smoking is critical to improving the health of this population.

In the mid-1990's the Agency for Health Care Policy and Research (AHCPR, now Agency for Healthcare Research & Quality, AHRQ) recommended specific practice guidelines for health providers to follow regarding all smokers. Abbreviated to the "5A's," they require primary care physicians to "ask", "advise", "assess", "assist", and "arrange" assistance, and are quick, easy, and inexpensive to apply across entire service systems. Their guidelines updated in 2000 emphasized the problem of a "disinclination among clinicians to intervene consistently" to help patients quit smoking in spite of the presence of "effective interventions" (Fiore et al., 2000). The guidelines were further updated in 2008, and the Surgeon General initiated a major public health initiative to address tobacco addiction (Fiore et al., 2008).

These reports from the Agency for Healthcare Research & Quality summarize strong evidence that implementation of the 5A's has clinical impact, including increased rates of quit attempts and increased smoking cessation across multiple populations. We thus studied whether implementing the 5A's through prescribing psychiatrists at six community mental health centers in the Baltimore region would reduce smoking among clinic patients diagnosed with serious mental illness. As previously reported, after six months of the intervention across six sites, 41% of patients had received one or more exposures to the 5A's during a visit to a site psychiatrist (Dixon et al., 2009) and 69% had received one or more exposures to the first 3A's (ask, advise, assess; henceforth "3A's"). Increased understanding of why the participating psychiatrists only partially implemented the intervention may help improve delivery of smoking cessation interventions to this at-risk population. Therefore, in this study, we first report the results of a clinician survey of psychiatrists and non-physician therapists conducted at the sites immediately prior to the intervention study to elicit perceived obstacles to implementing the 5A's. Secondly, we present multi-level analyses to determine the extent to which psychiatrist delivery (or not) of the 5A's to individual patients varied between patients and psychiatrists, and to what extent patient characteristics explained variation.

METHODS

Overview

We collaborated with six community mental health centers in the Greater Baltimore area to implement the 5A's at each patient-doctor visit for six months (Dixon et al., 2009). This consisted of: 1) *Ask* patients if they smoke. 2) *Advise* those who smoke to quit immediately. 3) *Assess* willingness to quit by asking patients how willing they are to attempt cessation using a 10-point readiness ruler which assessed "readiness to change" and whether they are ready to set a quit date within the next 30 days. 4) *Assist* patients who are willing to quit (6 or more on the readiness ruler) to make optimal quitting plans; assist those who reply negatively (5 or below) to nurture development of their motivation to quit. 5) *Arrange* for follow up (e.g., making appointments for group treatment, indicating that the topic will be discussed at the next visit).

The Institutional Review Boards at the University of Maryland School of Medicine and at each participating facility approved the study, conducted between March 2003 and February 2005. All participants provided written informed consent after receiving a full description of the study. Facility participation involved a commitment to clinic-wide delivery of the 5A's to all adult patients; a subset of patients were interviewed about their smoking status and related variables.

Training and Implementation

The study team engaged each center in activities to promote full delivery of the 5A's. These included pre-training clinic-wide publicity, psychiatrist training, provision of handouts and visual implementation aides, reminder trinkets for psychiatrists to give to patients as part of the "Assist" step, access to ongoing help from a physician clinic-study liaison, and web-based mid-term booster training. The initial in-person 90-minute psychiatrist training at each center included other interested non-prescribing clinicians who functioned as primary therapists (e.g., social workers, nurses) and presented the evidence base for the effectiveness of the 5A's in primary care. After that initial training, all attendees were anonymously surveyed regarding anticipated implementation obstacles. The survey inquired about the priority of implementing the 5A's compared to other clinic goals and asked participants to rate the extent to which they thought each of 17 different factors would pose a barrier to 5A's implementation. Because the Institutional Review Board required that responses remain anonymous, we could not link survey responses of the psychiatrists in the survey sample to later prescriber behavior.

Each clinic altered its psychiatrist chart-note form to include a standardized set of check boxes to document 5A's implementation which allowed determination of whether patients received the 5A's at each visit. After approximately two months and four months of the six-month study period, 20 randomly-selected patient charts were reviewed. De-identified information about the clinic's implementation was provided to psychiatrists at their own clinic. Because later feedback from clinicians revealed considerable confusion regarding how to code the 4th and 5th A's ("assist" and "arrange") when the patient had low motivation

for smoking cessation or refused treatment suggestions, we present data not only on delivery of the 5A's but also on the 3A's which we believe were more reliably and validly coded.

Main Study Patient Sample

Informed consent was obtained from 304 individuals with chart diagnoses of schizophrenia spectrum disorder, affective or other psychosis, age 18–64, who smoked at least one cigarette in the past month, were English-speaking, and had at least two appointments with their psychiatrist in the past six months at one of the participating centers. Participants consented to chart extraction to determine whether visits included the 5A's.

Data Analysis

Chart abstraction for 5A's and 3A's implementation—We rated each one-month period as “yes” if it contained at least one visit and any visit involved providing the 5A's; and “no” if it contained at least one visit but no 5A's were provided; and “not applicable” if there were no visits. A similar variable was constructed for the 3A's.

Multilevel Analysis Sample and Analytic model—Our aim was to test whether there was significant variance in probability of delivery of the 5A's and the 3A's between patients and between psychiatrists, and to examine patient factors associated with psychiatrist delivery of the 5A's and the 3A's. Of the 304 consented patients, 232 had at least 1 visit during the six month study period, producing a total of 639 observed patient months. We removed 22 observed patient-months when patients saw more than one psychiatrist *within* a single month, and 16 patient-months when psychiatrists were practicing at a secondary site. The analyses thus considered a total of 601 patient months and included 228 unique patients and 28 psychiatrists

To examine variance components in the probability of 5A's delivery, we used a three-level multilevel logistic regression model (using SAS 9.2 GLIMMIX) with individual patient and psychiatrist effects specified as random. Repeated patient months were specified at level 1, patient/psychiatrist pairs were at level 2 and were nested within sites (level 3). Clinics were specified as fixed due to their small number (6 sites). We estimated variance components as percentages of total variance using the method of Snijders and Bosker (1999). We examined the 3A's similarly.

To examine the association between patient factors and providing the 5A's, we added a select set of baseline patient variables at level 2 and used backward elimination until all remaining variables were significant ($p < .05$). These variables included: the Brief Psychiatric Rating Scale (Perkins, D., Stroup, T.S., & Lieberman, J.A., 2000) total score, Cohen's Perceived Stress Scale (Cohen, S., Kamarack, T., & Mermelstein, R., 1983) score, smoking severity (number of packs of cigarettes smoked in the prior 7 days), race, gender, and age. We included measures of stress and psychopathological symptom severity because high levels of these might compete with time to address smoking in the clinical encounter.

Finally, to assess the influence of patient readiness to change (assessed at the 3rd A, “Assess”) on whether psychiatrists delivered the 4th and 5th A (“Assist” and “Arrange”), we fit a third model for delivery of the 5A's in those patient-months in which the 3rd A was

delivered. For each patient-month, we dichotomized Readiness to Change to be “6 or greater” versus “5 or less”, with the former category indicating “readiness to quit.”

RESULTS

Pre-Intervention Survey of Site Clinicians (Psychiatrists and Non-physician Therapists)

A total of 49 clinicians from the six clinics completed the pre-intervention survey. Compared to other goals of their clinic, 15 (31%) rated the 5A's program as a medium priority, 25 (51%) rated it as a high priority, 7 (14%) rated it as a very high priority. Almost all (41, 84%) rated the program as very consistent with their personal philosophy of service delivery. Notably, the most endorsed barriers related to perceived lack of patient interest in smoking cessation and the impact of the intervention's demands on staff time and attention (see Table 1).

Multilevel Analyses

Of the patients in the current analysis sample, 51% (117/228) were male; 50% (113/228) were white and 47% (107/228) were African American; and, 75% (171/228) had schizophrenia and 25% (57/228) had affective or other psychosis disorders. Mean age was 44.6 years ($SD = 8.9$) and mean BPRS total was 34.7 ($SD = 8.2$). At the pre-intervention interview, patients reported they first started smoking at age 15.4 ($SD = 5.7$) and currently smoked 131 ($SD = 85$) cigarettes per week with only 4.9% (11/227) smoking 7 or less cigarettes per week.

The 5A's were delivered during 145 out of 601 (24%) of the patient-month periods. Table 2 presents the multilevel model for the 5A's. There was significant variance between patients (13.2% of total variance) and psychiatrists (21.9% of total variance) in the probability (i.e., odds) of delivery of the 5A's. There were no site differences ($F_{5,12} = .98, p = .47$) and after backward elimination, none of the patient factors predicted delivery of the 5A's.

The first 3A's were delivered during 311 out of 601 (52%) of the patient months. Table 3 presents the results of the initial and final (after entering patient factors) models for the probability of delivery of the 3A's. Only 1.6% of the total variance is accounted for by patient variance, whereas 22.8% of the variance is accounted for by variance between the psychiatrists. There were no site differences ($F_{5,12} = 1.33, p = .32$). In the final model, after backward elimination of patient factors, baseline smoking severity significantly predicted delivery of the 3A's. The odds of delivery of the 3A's increased about 5%, on average, for each additional pack of cigarettes the patient smoked per week; $\beta = .050$; adjusted odds ratio (OR) = 1.05; $p = .036$. Smoking severity explained about 31% (.5/1.6) of the initial variance between patients, but a small proportion of the total variance.

In the 311 patient-months in which the 3 A's were delivered, Readiness to Change was assessed (3rd A) in 306 of them, and 56 had Readiness to Change scores of 6 or greater (“readiness to quit”). Sixty-one percent (34/56) of those with Readiness to Change scores of 6 or greater were provided the full 5A's, whereas 43% (108/250) were provided the 5A's among those whose readiness to change scores were 5 or less (unadjusted OR = 2.1). Table 4 presents the results of the initial and final multilevel models for delivery of the 5A's

among the patient-months in which the 3A's were delivered. Patient "readiness to quit" status was highly predictive of delivery of the full 5A's, with the odds of 5A's delivery 6 times higher for patients who were "ready to quit" versus those who were not ($\beta=1.80$, adjusted OR = 6.05; $p = .003$).

DISCUSSION

The frequency of delivery of the 5A's during the intervention clearly fell short of implementation goals, but may also be viewed as a positive initial attempt to introduce smoking cessation treatment into mental health settings. Analysis of the pre-intervention clinician survey revealed a high level of support for delivery of the 5A's, but considerable perceived obstacles, especially lack of patient interest, and lack of clinicians' time in the face of excessive existing clinical demands. The multi-level analyses revealed that provider factors were more important than patient factors in determining 5A's delivery, accounting for substantially more variance than patient factors. These data together underscore the critical value of addressing mental health providers' perceptions and experiences in the effort to implement smoking cessation treatment.

Providers' beliefs regarding patients' lack of interest in smoking cessation persisted in spite of an explicit focus on this issue during the training. While most smokers experience difficulties quitting, previous research has shown that many adults with serious mental illness do have great interest and desire to quit (Lucksted, Dixon, & Semberly, 2000; Carosella, Ossip-Klein, & Owens, 1992), and can be successful (Dickerson et al., 2011). The persistence of providers' beliefs may be multiply-determined. They may hold unrealistic assumptions about the level of interest and success of smoking cessation in the general population, or not know about successful quitting among adults with serious mental illness. It is also possible that clinical interactions may become self-fulfilling; patients may sense that providers do not expect them to be motivated or do not believe they can quit, and they are therefore reluctant to express interest in smoking cessation or to try.

In addition, the 5A's have a role even for patients who do not immediately express motivation to quit. Notably, some psychiatrists expressed confusion regarding how to "assist" and "arrange" when patients indicated limited interest in quitting. The strong association between delivery of the full 5A's and patients expressed higher readiness to change in the analysis suggests a couple possibilities. Clinicians could have been uncertain regarding how to assist individuals with low motivation, or did not think further assistance would be valuable for individuals with low motivation. The training session addressed the expectation that many patients would have low readiness and specified approaches for these patients, such as low-key encouragement, and provision of stop-smoking tips, sugar free gum, and lists of treatment options should patients change their minds. However, it is likely that providers need more training to effectively help patients with low readiness or motivation.

It is noteworthy that clinicians predicted that a lack of time and the presence of other clinical demands would impede their ability to provide the 5A's. While the study did not try to measure these factors, administering the 5A's does take from 2 to 10 minutes on each

occasion. Thus, time pressure concerns may be quite legitimate especially when patients have other critical problems that appear more urgent than smoking. Not inconsistent with this, our analyses suggested that when smoking was considered more urgent (i.e., when smoking severity was greater), psychiatrists were more likely to take the time to deliver the first 3 A's. Clinics may need to articulate policies of how smoking cessation fits within overall clinical priorities and provide training to help clinicians devise strategies that allow them to provide the 5A's in a more measured way as well as instill confidence that the 5A's can be delivered in a brief period of time within the session.

Limitations of this study include the inability to link psychiatrist pre-intervention survey responses to their implementation of the program. In addition, our measure of program implementation relied on the chart documentation by the psychiatrists using a simple check-list embedded in chart notes. Nevertheless, this is one of the first studies to use empirical data to understand the challenges and determinants of providing smoking cessation treatment within mental health programs.

Current evidence-based practice guidelines underline the imperative for mental health practitioners to address smoking (Kleber, et al., 2007; Hall, S.M., & Prochaska, J.J., 2009; Ziedonis, D. et al., 2008). Creative and collaborative solutions are needed to ameliorate these various challenges and build effective strategies for smoking cessation treatment within mental health settings.

Acknowledgments

FUNDING

This study was supported by funding from the National Institute on Drug Abuse (NIDA R01 DA014393-03).

References

- Addington J, el-Guebaly N, Campbell W, Hodgins DC, Addington D. Smoking cessation treatment for patients with schizophrenia. *American Journal of Psychiatry*. 1998; 155(7):974–975. [PubMed: 9659869]
- Carosella AM, Ossip-Klein DJ, Owens CA. Smoking attitudes, beliefs, and readiness to change among acute and long term care inpatients with psychiatric diagnoses. *Addictive Behaviors*. 1992; 24(3): 331–344. [PubMed: 10400273]
- Centers for Disease Control and Prevention (CDC). Cigarette smoking among adults – United States, 2007. *Morbidity and Mortality Weekly Report*. 2008; 57(45):1221–1226. [PubMed: 19008790]
- Cohen S, Kamarack T, Mermelstein R. A global measure of perceived stress. *Journal of Health and Social Behavior*. 1983; 24:385–396. [PubMed: 6668417]
- de Leon J, Diaz FJ. A meta-analysis of worldwide studies demonstrates an association between schizophrenia and tobacco smoking behaviors. *Schizophrenia Research*. 2005; 76(2–3):135–157.10.1016/j.schres.2005.02.010 [PubMed: 15949648]
- Dickerson F, Bennett M, Dixon L, Burke E, Vaughan C, Delahanty J, DiClemente C. Smoking cessation in persons with serious mental illness: The experience of successful quitters. *Psychiatric Rehabilitation Journal*. 2011; 34(4):311–316.10.2975/34.4.2011.311.316 [PubMed: 21459747]
- Dixon LB, Medoff D, Goldberg R, Lucksted A, Kreyenbuhl J, DiClemente C, ...Afful J. Is implementation of the 5A's of Smoking Cessation at community mental health centers effective for reduction of smoking by patients with serious mental illness? *The American Journal on Addictions*. 2009; 18:386–392.10.1080/10550490903077747 [PubMed: 19874158]

- Fiore, MC.; Bailey, WC.; Cohen, SJ.; Dorfman, SF.; Goldstein, MG.; Gritz, ER.; ... Wewers, ME. Treating tobacco use and dependence: clinical practice guideline. Rockville, MD: U.S. Department of Health and Human Services. Public Health Service; 2000.
- Fiore, MC.; Jaen, CR.; Baker, TB.; Bailey, WC.; Benowitz, NL.; Curry, SJ.; ... Wewers, ME. Treating tobacco use and dependence, 2008 update: clinical practice guideline. Rockville, MD: U.S. Department of Health and Human Services. Public Health Service; 2008.
- Godtfredsen NS, Prescott E, Osler M. Effect of smoking reduction on lung cancer risk. *JAMA: The Journal of the American Medical Association*. 2005; 294(12):1505–1510.10.1001/jama.294.12.1505 [PubMed: 16189363]
- Hall SM, Prochaska JJ. Treatment of smokers with co-occurring disorders: emphasis on integration in mental health and addiction treatment settings. *Annual Review of Clinical Psychology*. 2009; 5:409–431.10.1146/annurev.clinpsy.032408.153614
- Himelhoch S, Lehman A, Kreyenbuhl J, Daumit G, Brown C, Dixon L. Prevalence of chronic obstructive pulmonary disease among those with serious mental illness. *American Journal of Psychiatry*. 2004; 161(12):2317–2319.10.1176/appi.ajp.161.12.2317 [PubMed: 15569908]
- Kleber HD, Weiss RD, Anton RF Jr, George TP, Greenfield SF, Kosten TR, ... Regier D. Treatment of patients with substance use disorders, second edition. American Psychiatric Association. *American Journal of Psychiatry*. 2007; 164(4 Suppl):5–123. [PubMed: 17569411]
- Lasser K, Boyd JW, Woolhandler S, Himmelstein DU, McCormick MD, Bor DH. Smoking and mental illness: A population-based prevalence study. *JAMA: The Journal of the American Medical Association*. 2000; 284(20):2606–2610.10.1001/jama.284.20.2606 [PubMed: 11086367]
- Lucksted A, Dixon LB, Semblly JB. A focus group pilot study of tobacco smoking among psychosocial rehabilitation clients. *Psychiatric Services*. 2000; 51:1544–1548.10.1176/appi.ps.51.12.1544 [PubMed: 11097651]
- Perkins, D.; Stroup, TS.; Lieberman, JA. Assessment of psychotic disorders. In: Rush, AJ., Jr, et al., editors. *American Psychiatric Association handbook of psychiatric measures*. Washington, DC: American Psychiatric Association; 2000. p. 485-513.
- Raudenbush, SW.; Bryk, AS. Hierarchical linear models. 2. Thousand Oaks, CA: Sage; 2002.
- Snijders, T.; Bosker, R. Multilevel analysis. London: Sage; 1999.
- U.S. Department of Health and Human Services (USDHHS). The health effects of active smoking: A report of the surgeon general. Washington, D.C: U.S. Government Printing Office; 2004.
- Waxmonsky JA, Thomas MR, Miklowitz DJ, Allen MH, Wisniewski SR, Zhang H, ... Fossey MD. Prevalence and correlates of tobacco use in bipolar disorder: Data from the first 2000 participants in the systematic treatment enhancement program. *General Hospital Psychiatry*. 2005; 27(5):321–328.10.1016/j.genhosppsych.2005.05.003 [PubMed: 16168792]
- Ziedonis D, Hitsman B, Beckham JC, Zvolensky M, Adler LE, Audrain-McGovern J, ... Riley WT. Tobacco use and cessation in psychiatric disorders: National Institute of Mental Health report. *Nicotine & Tobacco Research*. 2008; 10(12):1691–1715.10.1080/14622200802443569 [PubMed: 19023823]

Table 1

Pre-Intervention Survey of Psychiatrist and Non-Prescribing Clinician Attitudes and Beliefs Regarding Smoking Cessation Treatment and the 5A's (N=49)

To what extent do you think the following items will be important obstacles that could hinder implementation of the 5A's smoking intervention in your clinic?) ¹	Mean	SD
Lack of interest among patients about smoking and/or smoking cessation	3.32	1.045
Too many demands on staff already to implement a new practice	2.90	1.016
Carrying out the 5A's at every patient visit will take up too much time	2.74	1.052
Staff skepticism about the value of the 5A's	2.57	.807
Low priority given to smoking in this clinic.	2.35	.887
Difficulty of implementing the 5A's intervention in everyday clinical practice	2.34	1.069
Carrying out the 5A's intervention requires too great a change in staff attitudes or behaviors	2.25	.863
Physicians will assume that the 5A's intervention will be ineffective	1.84	.976
The 5A's intervention is too confusing	1.76	.794
Lack of competent personnel to carry out the 5A's	1.76	.822
Addictions are so unchangeable that it is useless to try the 5A's intervention	1.63	.866
Lack of guidance & leadership to implement the 5A's	1.60	.809
Physicians at this clinic will be uncomfortable raising the issue of smoking with their patients	1.49	.621
The 5A's conflicts with established clinic practices or behaviors	1.45	.663
Expense of the 5A's to the clinic	1.42	.826
Interference by the administration or staff at this clinic in implementing the 5A's intervention	1.39	.586
The study accompanying the 5A's intervention is unclear or troubling	1.34	.608

¹ 1: Not at all important; 2: Almost not at all important; 3: Moderately important; 4: Very Important; 5: Critically important

Table 2

Final two-level multilevel logistic model for probability of delivery of the 5A's during patient-month periods (601 patient-months)

Fixed Effects	β	SE	t-test statistic (df =12)	p
Intercept	-3.00	.93	-3.22	.01
Site 1	1.28	1.02	1.25	.23
Site 2	1.47	1.13	1.30	.22
Site 3	1.76	1.14	1.55	.15
Site 4	2.35	1.12	2.10	.06
Site 5	1.12	1.15	.97	.35
Site 6 (reference)	0	.	.	.
Random Effect	Variance Component	Likelihood Ratio Test		p
Patient ¹	.67	$\chi^2_1=19.0$		<.001
Psychiatrist ²	1.11	$\chi^2_1=10.3$		<.001
Variance decomposition (estimated proportion of total variance) ³				
Patient	13.2			
Psychiatrists	21.9			

Note. β = fixed effect coefficient; SE = standard error.

¹ χ^2 likelihood ratio test of null hypothesis that patient variance component equals zero.

² χ^2 likelihood ratio test of null hypothesis that psychiatrist variance component equals zero, given patient random effect is in the model.

³ Estimates based on method of Snijders and Dosker (1999).

Table 3

Results from initial and final multi-level logistic models for probability of delivery of the first 3A's during patient-month periods.

Model 1 - Initial (601 patient-months)						Model 2 - Final (599 patient-months)					
Fixed Effects	β	SE	t-test statistic (df=12)	p		β	SE	t-test statistic (df=12)	p		
Intercept	-.60	.65	-.94	.37		-.62	.64	-.97	.35		
Site 1	1.34	.78	1.73	.11		1.38	.77	1.78	.10		
Site 2	-.35	.89	-.40	.70		-.28	.89	-.32	.75		
Site 3	.44	.89	.49	.63		.39	.89	.43	.67		
Site 4	.58	.88	.66	.52		.61	.88	.69	.50		
Site 5	.07	.90	.08	.94		.024	.89	.03	.98		
Site 6 (reference)	0	.	.	.		0	.	.	.		
Smoking Severity ¹	-	-	-	-		.050	.02	2.11	.036		
Random Effect	Variance Component		Likelihood Ratio Test	p		Variance Component		Likelihood Ratio Test	p		
Patient ²	.07		$\chi^2_1=6.81$	.009		.05		$\chi^2_1=6.09$	.014		
Psychiatrist ³	.99		$\chi^2_1=26.5$	<.001		.99		$\chi^2_1=27.2$	<.001		
Variance decomposition (estimated percentage of total variance) ⁴											
Patient	1.6					1.1					
Psychiatrists	22.8					22.8					

Note. β = fixed effect coefficient; SE = standard error.

¹ t-test df = 360 for significance test of Smoking Severity

² χ^2 likelihood ratio test of null hypothesis that patient variance component equals zero.

³ χ^2 likelihood ratio test of null hypothesis that psychiatrist variance component equals zero, given patient random effect is in the model.

⁴ Estimates based on method of Snijders and Dosker (1999).

Table 4

Results from initial and final multi-level logistic models for probability of full 5A's delivery during the patient-month periods in which the patient received the first 3A's.

Model 1 - Initial (311 patient-months)					Model 2 – Final (306 patient-months)				
Fixed Effects	β	SE	t-test statistic (df=6)	p	β	SE	t-test statistic (df=5)	p	
Intercept	−2.04	1.17	−1.74	.13	−2.40	1.21	−1.97	.11	
Site 1	.84	1.27	.66	.53	.72	1.28	.56	.60	
Site 2	3.49	1.57	2.21	.07	3.48	1.60	2.17	.08	
Site 3	2.72	1.43	1.90	.11	2.91	1.46	1.99	.10	
Site 4	3.81	1.57	2.43	.05	4.18	1.63	2.56	.05	
Site 5	1.64	1.45	1.13	.30	1.31	1.44	.91	.41	
Site 6 (reference)					0				
Readiness to Change score	6? Y/N ¹	-	-	-	1.80	.59	3.04	.003	
Random Effect	Variance Component	Likelihood Ratio Test	p	Variance Component	Likelihood Ratio Test	p			
Patient ²	1.69	$\chi^2_1=21.1$	<.001	2.05	$\chi^2_1=21.1$	<.001			
Psychiatrist ³	1.17	$\chi^2_1=5.1$	.024	1.08	$\chi^2_1=24.9$	<.001			
Variance decomposition (estimated percentage of total variance) ⁴									
Patient	27.5			31.9					
Psychiatrists	19.0			16.8					

Note. β = fixed effect coefficient; SE = standard error.

¹ Range of Readiness to Change Score (average across visits if > 1 visit within patient month) is 0 to 10. t-test df = 126.

² χ^2 likelihood ratio test of null hypothesis that patient variance component equals zero.

³ χ^2 likelihood ratio test of null hypothesis that psychiatrist variance component equals zero, given patient random effect is in the model.

⁴ Estimates based on method of Snijders and Bosker (1999).