Age and gender considerations for technology-assisted delivery of therapy for substance use disorder treatment: A patient survey of access to electronic devices

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Abstract

Background—Technology-assisted treatment (TAT) can be an effective supplement to established face-to-face therapy modalities with a growing literature in substance use disorder (SUD) treatment. TAT access, interest, and familiarity are potential limitations to the use and efficacy of these approaches to treatment.

Methods—174 participants in outpatient SUD treatment were administered a survey regarding technology device and Internet access, and interest in engaging in TAT SUD counseling (SUDC). The group was dichotomized by mean age and gender to examine potential variations in in these subgroups.

Results—Forty-three (43%) of participants were female, and the mean age was 44.8 years, and 89% of participants had Internet access. 83% of participants were interested in TAT for SUD counseling; 81% expected it to be at least "moderately helpful." 34% of participants noted they would choose to continue face-to-face therapy exclusively. 91% of participants had cell phones, but only 50% could access data or the Internet via their handheld device. 80% of participants stated they would be interested in trying SUDC via their phone. Women had a higher preference for computer-based SUDC than men, with gender being significantly correlated with TAT perceive helpfulness.

Conclusion—These findings suggest that patients in outpatient SUD treatment have access to resources for TAT implementation, although access was not always readily available. Future research will be needed to determine whether the technology that this population possesses will be able to support the evolving TAT modalities and whether interest in TAT across age and gender groups equalizes over time.

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Keywords

electronic devices; addiction; substance use disorder treatment; technology-assisted treatment

1. Introduction

Interest in providing technology-assisted treatment (TAT) for substance use disorder (SUD) treatment has grown in recent years (Ondersma et al., 2014; Voith and Berger, 2014; Wood et al., 2014; Ramsey, 2015). Such approaches include simple information that can be accessed via the web (e.g., webmd.com), electronic diaries (Moore et al., 2011a), treatment services that are provided via the web, as well as interactive treatment programs that are provided via locally sited computers or mobile phone applications (Moore et al., 2011b). TAT as a therapy add-on to face-to-face treatment has outperformed treatment as usual in randomized trials (Carroll et al., 2008; Carroll et al., 2009; Carroll et al., 2014), yielding more drug-free urine samples in a clinical trial, as well as significantly longer continuous abstinence by self-report and higher rates of drug-free urines in follow-up. Short message service (SMS) has been shown to be effective in improving self-management of medical illnesses including diabetes, hypertension, and asthma (de Jongh et al., 2012; Hall et al., 2015). Ecological momentary interventions (EMIs) are an additional form of treatment that can be delivered via handheld devices such as mobile phones, and EMIs have been developed for a variety of behaviorally related disorders including SUDs (Hall et al., 2015).

These potential TAT modalities have promising innovative features, including cost-effectiveness (Rooke et al., 2010), increased efficiency in comparison to traditional clinical models of care, and the potential to augment standardized forms of treatment provided. Exploration of these modalities has yielded a growing literature regarding patient access to technology (e.g., computer, cell phone, internet) needed for electronically delivered services. Surveys in the general patient population have indicated that older, poorer, less educated, racial/ethnic minorities (López et al., 2011; McClure et al., 2013), and rural dwellers are less likely to use the Internet (Wang et al., 2011). Reported rates of Internet access amongst SUD treatment participants range from 20% to 72% (King et al., 2009; VanDeMark et al., 2010; McClure et al., 2013). A survey of computer and cell phone use by patients in SUD treatment found that those with a high school diploma or yearly income greater than $15k were more likely to use computers, and African-American patients were less likely to use text messaging (McClure et al., 2013). More recent literature has demonstrated that participants in substance abuse treatment have a utilization rate of smart phone and mobile applications similar to the general US population (Dahne and Lejuez, 2015).

Though more information is needed to determine the potential effectiveness of TAT for SUDs, a pragmatic issue is whether SUD treatment participants would have sufficient technology access to engage in technology-assisted treatment modalities. Literature suggests that participants in SUD treatment would not have technology sophisticated enough to utilize existing mobile technology (Milward et al., 2015). Another important factor that merits consideration is SUD treatment participants' acceptance of technology-assisted treatment. The present report provides data from a survey of active SUD treatment

participants. The goals of the survey were to characterize access to electronic devices, patient attitudes towards incorporation of technology-assisted therapies into their current treatment regimen, and to see how these characteristics varied as a function of demographic features (especially age). Characterization of these issues would expand on the existing literature regarding mobile technology ownership and possible perceived barriers to TAT utilization.

2. Methods

2.1. Study population and setting

A cross-sectional survey of 174 individuals was conducted between November 2011 and October 2012. The survey was conducted in five substance treatment clinics in Baltimore City. Two programs were opioid treatment programs (OTP), one was an office-based opioid treatment (OBOT) site that prescribed buprenorphine as a part of a primary care practice, and two were outpatient substance use disorder treatment programs that enrolled a mix of methadone/buprenorphine and non-methadone/buprenorphine treated patients. Participants were recruited via fliers posted at programs advertising the study. Eligibility for participation included voluntary enrollment in SUD treatment and willingness to participate in the survey. The institutional review board of the Johns Hopkins Medical Institutions approved the project.

2.2. Measures

A 21-item survey was developed for this project. Items queried demographic information (sex; marital status; age; race; ethnicity), access to electronic devices at home and other settings, attitudes towards technology-assisted substance use disorder counseling, and opinions regarding the amount and type of counseling the patient needed. (Please see supplemental materials for a full list of the survey questions).

2.3. Data Collection

A research assistant available at selected times during program operations administered the survey in a single interaction. Survey encounters typically lasted less than 30 minutes. Participants were compensated $10 for completing the survey.

2.4. Data Analysis

Descriptive characteristics (mean, median, range and SD) were used to summarize the responses. Subgroup analyses were performed; one analysis categorized the sample by mean age (44 vs. 45 years), gender, and opioid maintenance treatment (OMT) status (buprenorphine vs. methadone vs. non-OMT). Current literature suggests technology-assisted treatment may be an effective partial replacement for methadone maintenance treatment counseling (Marsch et al., 2014), so analysis by OMT status was performed to provide insight into whether the different OMT groups had varying attitudes towards TAT during SUD treatment. Group comparisons were performed using t-tests for continuous and chi-square analyses for categorical measures. A regression analysis with age, availability of Internet/e-mail access, past computer-based SAC, and gender the independent variables, and the perceived helpfulness of computer-based SAC the dependent variable, was conducted.

3. Results

3.1. Demographic and participant information (Table 1)

57% of participants were male, mean age was 44.8 years, and median age was 47 years (range 19-64). 54% of participants were African-American. 25% of participants were in methadone maintenance treatment, 25% were receiving buprenorphine treatment, and 26% took no opioid agonist medication. 24% of participants had an unknown OMT status.

3.2. Technology Access

3.2.1. Access to computers and Internet—Data are presented for home and non-home locations. 56% of participants had a computer at home, and 40% had a computer only at a non-home site (Figure 1). Additionally, 88% of all participants reported that they had access to a computer at a library, treatment center, or the home of friends and family. 91% of all participants reported Internet access at home or elsewhere via computer (Figure 1).

About one-half (51%) of all participants had computer Internet access at home, demonstrating that most persons who had a computer at home (56% of total study population) had it connected to the Internet. Among those with Internet access at home, 51% had used their home computer for Internet access >4 times per week.

3.2.2. Access to computers and the Internet as a function of age—Comparison between the two age groups (44 vs. 45) demonstrated that the 9% of the study population (n=16) without internet access were all 45 years of age or older (Figure 1, p<.0003). Further comparisons between these age groups failed to demonstrate other statistically significant differences in technology access via computer at home or at other sites.

3.2.3. Cellular phone access—Participants were surveyed for access to cell phones, as well as the capability of their devices. 160 of 174 (92%) of participants had cell phones, with no statistically significant difference when dividing participants into groups based on age (44 vs. 45 years; p=.53). However, there was a statistically significant difference in use of text messaging, with 92% of the younger participants (44 years) having text-enabled phones, and only 66% of older participants (45 years) having such access (p<.0002). The younger group also showed trends towards having more data and internet access on their phone (54% vs. 40%, p=.09) and more app-enabled phones (37% vs. 25%, p=.10)

3.3. Interest in TAT for SUD counseling (SUDC)

3.3.1. Overall Interest—Results for questions regarding participants' interest in technology assisted SUD counseling (SUDC) are shown in Figure 2. Eighty-three percent (83%) of the total population was interested in technology-assisted SUDC in some capacity, with 14% not interested (3% not sure). Participants were asked if they would expect to find technology-assisted substance use disorder treatment helpful; response options were: very helpful, moderately helpful, little helpful, or not at all. 81% of all participants expected this method of treatment to be moderately or very helpful.

Participants were also asked what they would prefer as their treatment moving forward. The options were to start TAT exclusively, continue to have face-to-face treatment, or commence a combined model with both face-to-face and TAT elements. 63% of participants responded that they would like to have TAT added to their current treatment, 33% responded they did not want to incorporate TAT at all, and 4% responded that they would want TAT alone.

3.3.2. Interest in TAT for SUD counseling as a function of age—When the population was dichotomized by mean age, nearly identical proportions were interested in technology-assisted SUDC (Figure 2). However, there was a trend for the older group (45 years) to be less interested than the younger group (44 years) in incorporating technology-assisted counseling into their current treatment regimen (60% vs. 74%, p=.062).

80% of all participants stated they would be interested in trying substance use disorder treatment via their phone, with no difference in response when considering age (85% of those 44 years vs. 89% of those 45 years).

3.3.3. Interest in TAT for SUD counseling as a function of gender—Women had a higher preference rating for computer-based substance abuse counseling than men (92% vs. 76%, p<0.05), but there was no statistically significant gender difference for cell-phone based SUD treatment or face-to-face vs. TAT preference. Within the regression analysis of helpfulness of computer-base SAC, gender was the only independent variable with a significant effect (<0.005), with women more likely to find this modality helpful.

3.3.4. Opioid maintenance vs. non-opioid maintenance treatment—The opioid maintenance treatment (OMT) status was known for 133 participants of the 174. Of the 133 participants with known OMT status, 33% were in methadone maintenance treatment (MMT), 32% were in office-based buprenorphine treatment (OBOT), and 35% were in an SUD treatment program without any opioid agonist medication prescribed. There was no significant difference in general interest in technology-assisted treatment between groups for MMT (80% interested), OBOT (88% interested), non-agonist group (80% interested; p=.75).

There was also no statistically significant difference between groups when asked about perceived helpfulness of TAT. The OBOT group tended to prefer a combined treatment model (21% face-to-face treatment only, 74% combined technology-assisted and face-to-face treatment, 5% technology-assisted treatment only). These OBOT group ratings of treatment model preference (face-to-face, combined or TAT only) varied from the responses from the MMT group (41%, 55%, 5%, respectively) and the non-agonist group (41%, 59%, 0%, respectively) but were not statistically different (p=.13). The three OMT status groups had similar responses when asked if they needed more treatment, less treatment, or the same amount than they were currently receiving. Between 57 to 60% of respondents in the groups reporting they needed no more and no less treatment, and 28-37% reporting they needed more treatment.

Participants were asked to identify all areas in need of additional treatment. Across the three OMT status groups, drug use (49% of participants) and employment status (45% of participants) were most frequently identified as needing focus. There was less perceived

need for more SUDC in MMT participants than noted by the other OMT groups (32% in the MMT, 60% in OBOT, and 54% in the non-agonist group) and greater need for medical illness education in participants receiving buprenorphine (30% in MMT, 44% in OBOT, and 30% in the non-agonist group).

4. Discussion

This study adds to a growing literature and complements work on the use of TAT for delivery of SUD treatment. This survey assessed patients in outpatient SUD treatment at a variety of clinics that primarily draw from urban settings that have a high rate of opioid use disorders, and provided an opportunity to examine the interplay of age, gender, and OMT status (MMT, OBOT, or non-agonist treatment) in TAT preferences.

The present findings provide further data about access to the Internet and cell phone technologies by patients in SUD treatment. A unique feature of this report is the examination of technology access and attitudes towards TAT for SUD treatment as a function of age and gender. Although age was not significantly associated with patient attitudes, gender had a significant association. A literature search identified one previously published manuscript that found gender differences in attitudes towards a computer-based Spanish education modality (Taylor and Nikolova, 2004). The manuscript found that women had a higher preference the computer-based version instead of the standard paper format. No similar literature was found for computer-based treatment within the substance use disorder field. The statistically significant gender differences in the present manuscript should be explored further in future research. These finding may correspond to treatment implications (i.e. differences in the quantity of TAT utilization) between gender groups when TAT is implemented.

The age subgroup analysis was performed under the assumption that age would be a key determinant of TAT interest. Though the findings did not reach significance, there were trends that older persons (45 years) would be less inclined to use TAT for SUD treatment (p=.062). With a higher-powered sample size, a better characterization of technology access and interest along generational lines (Baby-boomer, Generation X, Generation Y/Millennial) could be obtained. With technology being introduced earlier in life to persons in younger generations, one could foresee an equilibration of rates of personal access to and TAT acceptance in SUD treatment populations across age groups.

The survey in this study characterized patients' access to electronic devices. With increasing TAT utilization, future research should explore ways to quantify patients' meaningful use of technology in their daily lives, as this could be a proxy for technology competency. Doing so would allow clinicians and researchers to anticipate client and participant difficulties when using TAT computer interfaces. Given the ever-changing context of social media sites and technology devices, a universal measure of the number of social media site accounts and the number of Internet-accessible electronic devices would be a practical approach that would account for the inevitable evolution of technology content. More advanced technology interactions should also be included (e.g., computer programming, website design) as such experience may be a more sensitive indicator of TAT preference. Before use of any

assessment of meaningful technology use, psychometric analysis would be necessary for validation purposes.

The present report suggests that there is still a current gap in attitudes towards TAT. With an aging substance use population (Larney et al., 2015), novel TAT modalities should consider the age of the target population, and treatment programs should use a patient-centered model to meet their clients' desired balance between TAT and face-to-face modalities. Though many participants in this study were open to TAT and would expect to find it helpful, participants voiced preference to have this therapy applied as a supplement to face-to-face interactions. Participants also noted that areas of further need were mostly related to drug use and employment, which could be specifically targeted by future technology-assisted therapeutics.

The study found that there were high rates of access to computers, the Internet, and cell phones (including phones with SMS) for these participants, although access was not always readily available in a home. These results suggest the current interest in using electronic devices as mechanisms for delivering substance use disorder treatment would have a sizable population of participants able to access such services with some limitations (i.e. men, persons with no internet access). Further research is needed to determine whether the available electronic devices within the SUD treatment population contain the software capabilities and data connectivity to utilize existing SUD treatment technologies.

For cell phones, 91% of the participants surveyed had access, 40% of which used advanced cell phone technologies. These data indicate a similar prevalence as the general American adult population, of whom 91% have cell phones (Smith, 2011), and 46% of whom have "smartphones" with Internet and email capability (Smith, 2012). The participant population with smartphones could potentially receive SMS or EMIs. This passive behavioral intervention has been useful in management of other chronic disease conditions (Heron and Smyth, 2010; de Jongh et al., 2012; Ramsey, 2015) and is a potential approach for novel substance use disorder interventions.

There are several limitations to this study. Information on OMT status was missing for 24% of participants. Initially, the investigators planned to go to clinics with homogeneous populations with this regard (e.g., solely providing methadone). Over time, we expanded the target clinics and included another clinic that offered more treatment options (OMT, OBOT, and non-agonist) but the approved survey did not capture certain psychosocial factors (i.e. income). Although adequate to demonstrate a difference in our primary outcome, our sample size was perhaps not sufficient to show statistically significant differences in some survey aspects, including phone access. Another limitation is the dichotomization of our attitude questions. Dichotomization has been shown to be problematic in the literature (MacCallum et al., 2002; Fitzsimons, 2008) due to loss of variability of the responses. Future surveys should utilize Likert scale responses to capture better the variability of patient attitudes.

Despite these limitations, this work provides further evidence that electronic devices may have a valuable role in the delivery of novel treatments for persons with SUDs, and there would be a patient population with an interest in this type of treatment. While such treatment

is unlikely to supplant the traditional face-to-face counseling relationship that has been an integral part of the SUD treatment, TAT service has the potential to play an important and cost-effective role within the SUD treatment system. A clear reimbursement structure for providers utilizing TAT during SUD treatment would also make it a more viable option(Ramsey, 2015).

5. Discussion

Findings from this study help to further support the development of TAT as novel treatment aids for SUD treatment by highlighting consideration for age, gender, and meaningful use of technology. Given the rapid rate of technology evolution, an aging SUD treatment population and the financial burden of maintaining up-to-date personal technology, future research should reassess gender and age differences seen in the present study to determine whether the devices that this population possess are capable of utilizing innovative TAT. Without harmonization of new TAT interventions with the variable levels of technology access and interest in the SUD treatment population, especially across gender groups, budding innovative TAT modalities may go underutilized.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

References

Ramsey AT. Integration of Technology-Based Behavioral Health Interventions in Substance Abuse and Addiction Services. International Journal of Mental Health and Addiction. 2015:1–11.

Ondersma SJ, Svikis DS, Thacker LR, Beatty JR, Lockhart N. Computer-delivered screening and brief intervention (e-SBI) for postpartum drug use: a randomized trial. J Subst Abuse Treat. 2014; 46:52–59. [PubMed: 24051077]

Voith L, Berger L. Computer-Assisted Substance Abuse Treatment: An Interview With Richard Cloud, PhD. Journal of Social Work Practice in the Addictions. 2014; 14:211–218.

Wood SK, Eckley L, Hughes K, Hardcastle KA, Bellis MA, Schrooten J, Demetrovics Z, Voorham L. Computer-based programmes for the prevention and management of illicit recreational drug use: A systematic review. Addict Behav. 2014; 39:30–38. [PubMed: 24144590]

Moore TM, Elkins SR, McNulty JK, Kivisto AJ, Handsel VA. Alcohol use and intimate partner violence perpetration among college students: Assessing the temporal association using electronic diary technology. Psychology of Violence. 2011a; 1:315–328.

Moore BA, Fazzino T, Garnet B, Cutter CJ, Barry DT. Computer-based interventions for drug use disorders: A systematic review. J Subst Abuse Treat. 2011b; 40:215–223. [PubMed: 21185683]

Carroll KM, Ball SA, Martino S, Nich C, Babuscio TA, Nuro KF, Gordon MA, Portnoy GA, Rounsaville BJ. Computer-assisted delivery of cognitive-behavioral therapy for addiction: a randomized trial of CBT4CBT. 2008

Carroll KM, Ball SA, Martino S, Nich C, Babuscio TA, Rounsaville BJ. Enduring effects of a computer-assisted training program for cognitive behavioral therapy: a 6-month follow-up of CBT4. CBT Drug Alcohol Depend. 2009; 100:178–181. [PubMed: 19041197]

Carroll KM, Kiluk BD, Nich C, Gordon MA, Portnoy GA, Marino DR, Ball SA. Computer-Assisted Delivery of Cognitive-Behavioral Therapy: Efficacy and Durability of CBT4CBT Among Cocaine-Dependent Individuals Maintained on Methadone. Am J Psychiatry. 2014; 171:436–444. [PubMed: 24577287]

de Jongh T, Gurol-Urganci I, Vodopivec-Jamsek V, Car J, Atun R. Mobile phone messaging for facilitating self-management of long-term illnesses. The Cochrane Library. 2012

Hall AK, Cole-Lewis H, Bernhardt JM. Mobile text messaging for health: a systematic review of reviews. Annu Rev Public Health. 2015; 36:393–415. [PubMed: 25785892]

Rooke S, Thorsteinsson E, Karpin A, Copeland J, Allsop D. Computer-delivered interventions for alcohol and tobacco use: a meta-analysis. Addiction. 2010; 105:1381–1390. [PubMed: 20528806]

López L, Green AR, Tan-McGrory A, King R, Betancourt JR. Bridging the digital divide in health care: the role of health information technology in addressing racial and ethnic disparities. Joint Commission Journal on Quality and Patient Safety. 2011; 37:437–445. [PubMed: 22013816]

McClure EA, Acquavita SP, Harding E, Stitzer ML. Utilization of communication technology by patients enrolled in substance abuse treatment. Drug Alcohol Depend. 2013; 129:145–150. [PubMed: 23107600]

Wang JY, Bennett K, Probst J. Subdividing the digital divide: differences in internet access and use among rural residents with medical limitations. J Med Internet Res. 2011; 13:e25. [PubMed: 21371989]

King VL, Stoller KB, Kidorf M, Kindbom K, Hursh S, Brady T, Brooner RK. Assessing the effectiveness of an Internet-based videoconferencing platform for delivering intensified substance abuse counseling. J Subst Abuse Treat. 2009; 36:331–338. [PubMed: 18775625]

VanDeMark NR, Burrell NR, LaMendola WF, Hoich CA, Berg NP, Medina E. Research An exploratory study of engagement in a technology-supported substance abuse intervention. 2010

Dahne J, Lejuez CW. Smartphone and Mobile Application Utilization Prior to and Following Treatment Among Individuals Enrolled in Residential Substance Use Treatment. J Subst Abuse Treat. 2015; 58:95–99. [PubMed: 26231698]

Milward J, Day E, Wadsworth E, Strang J, Lynskey M. Mobile phone ownership, usage and readiness to use by patients in drug treatment. Drug Alcohol Depend. 2015; 146:111–115. [PubMed: 25468818]

Taylor G, Nikolova O. Influence of gender and academic ability in a computer-based Spanish reading task. Roeper Review. 2004; 27:42–51.

Smith A. Americans and text messaging: 31% of text message users prefer texting to voice calls, and young adults stand out in their use of text messaging. Pew Internet & American Life Project. 2011

Smith A. 46% of American adults are smartphone owners. Pew Internet & American Life Project. 2012

Heron KE, Smyth JM. Ecological momentary interventions: incorporating mobile technology into psychosocial and health behaviour treatments. British journal of health psychology. 2010; 15:1–39. [PubMed: 19646331]

MacCallum RC, Zhang S, Preacher KJ, Rucker DD. On the practice of dichotomization of quantitative variables. Psychol Methods. 2002; 7:19. [PubMed: 11928888]

Fitzsimons GJ. Death to dichotomizing. Journal of Consumer Research. 2008; 35:5–8.

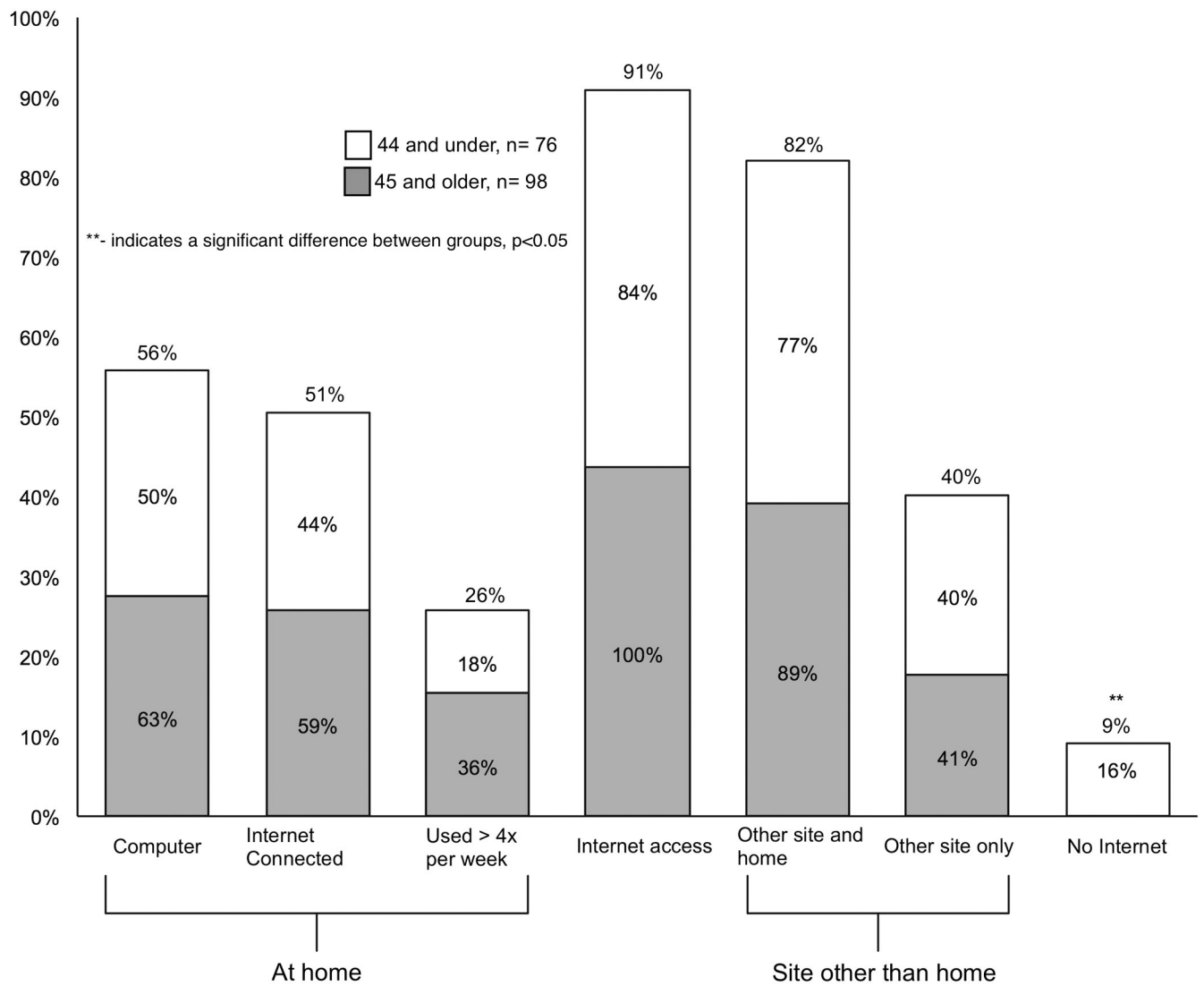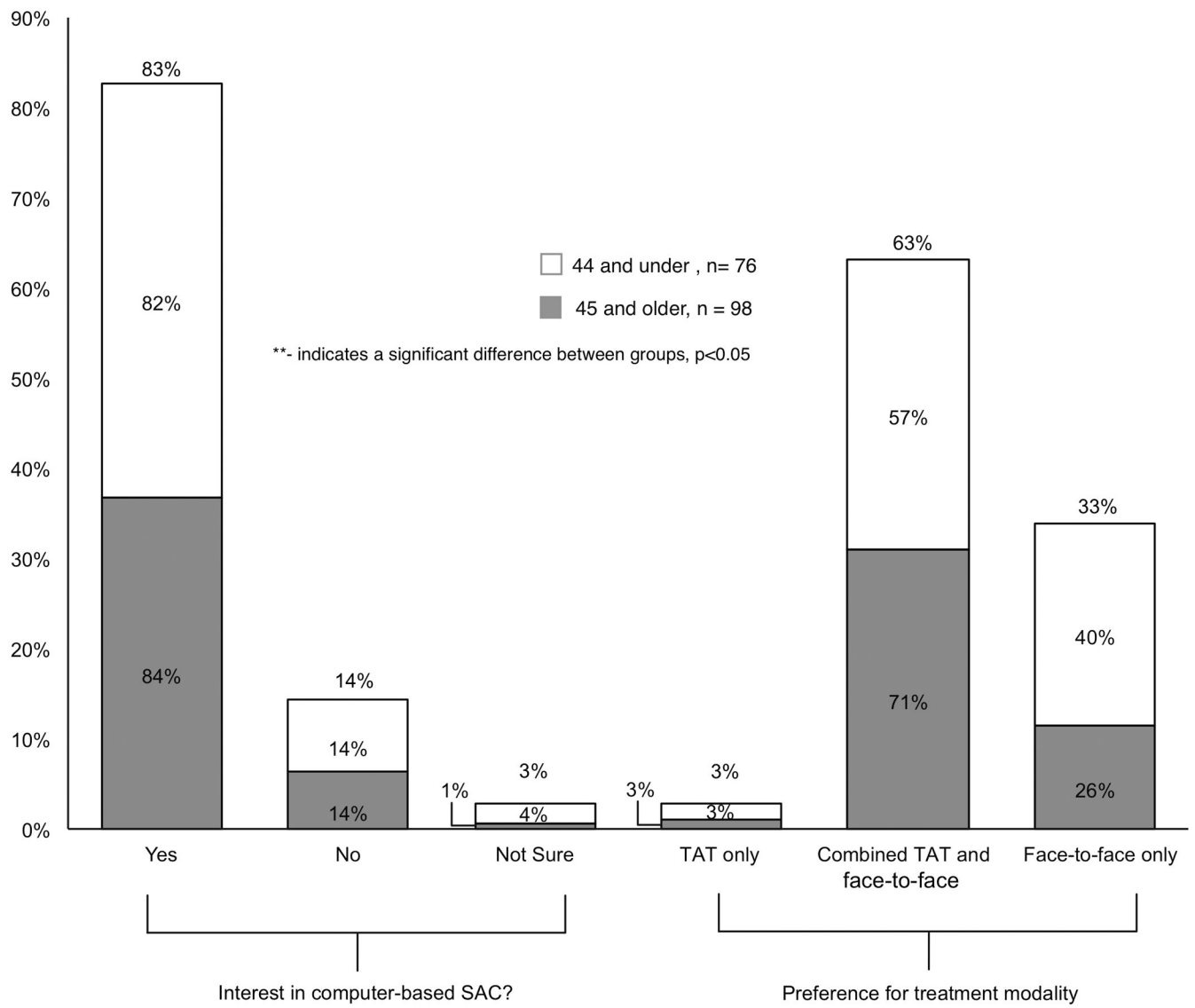**Figure 1. Internet access as a function of age, n= 174**

Figure 2. Preferred treatment modality as a function of age

Table 1

Demographics (n=174)	#	%
Gender		
Male	100	57.5%
Female	74	42.5%
Race/Ethnicity *		
American Indian/Alaska Native	3	1.7%
Black or African-American	92	52.9%
Hispanic/Latino	3	1.7%
White	75	43.1%
Employment		
Unemployed	146	83.9%
Part-time	10	5.7%
Full-time employment	18	10.3%
Medication		
Methadone	44	25.3%
Buprenorphine	43	24.7%
None	46	26.4%
Uknown	41	23.6%
Mean age (years; range)	44.8 (19-64)	

*
Data missing on one subject