HHS Public Access

Author manuscript

Health Psychol. Author manuscript; available in PMC 2015 December 16.

Published in final edited form as:

Health Psychol. 2015 December ; 34(0): 1278–1285. doi:10.1037/hea0000254.

Randomized Controlled Trial of a Web-based Indoor Tanning Intervention: Acceptability and Preliminary Outcomes

Jerod L. Stapleton,
Division of Population Sciences, Rutgers Cancer Institute of New Jersey

Department of Medicine, Rutgers Robert Wood Johnson Medical School

Department of Health Education and Behavioral Sciences, Rutgers School of Public Health

Sharon L. Manne,
Division of Population Sciences, Rutgers Cancer Institute of New Jersey

Department of Medicine, Rutgers Robert Wood Johnson Medical School

Department of Health Education and Behavioral Sciences, Rutgers School of Public Health

Katie Darabos,
Division of Population Sciences, Rutgers Cancer Institute of New Jersey

Kathryn Greene,
Department of Communication, Rutgers, The State University of New Jersey

Anne E. Ray,
Center of Alcohol Studies, Rutgers, The State University of New Jersey

Amber L. Turner, and
Division of Population Sciences, Rutgers Cancer Institute of New Jersey

Elliot J. Coups
Division of Population Sciences, Rutgers Cancer Institute of New Jersey

Department of Medicine, Rutgers Robert Wood Johnson Medical School

Department of Health Education and Behavioral Sciences, Rutgers School of Public Health

Abstract

Objective—This manuscript describes the acceptability and preliminary behavioral outcomes from a pilot randomized control trial of a web-based indoor tanning intervention for young adult women. The intervention targets indoor tanning user's perceptions of then benefits and value of tanning and addresses the role of body image-related constructs in indoor tanning.

Methods—Participants were 186 young adult women who reported indoor tanning at least once in the past 12 months. The study design was a 2-arm randomized controlled trial with pre and post assessments and random assignment to an intervention or control condition. Intervention

Correspondence concerning this article should be addressed to Jerod Stapleton, Rutgers Cancer Institute of New Jersey, 195 Little Albany Street, New Brunswick, NJ 08903.

acceptability was assessed by obtaining participants' evaluation of the intervention. Regression analyses were used to test for intervention condition differences in preliminary behavioral outcomes measured at 6-weeks post-intervention.

Results—Participants provided favorable evaluations of the intervention on several dimensions and a highly positive overall rating. Intervention participants were more likely to report abstaining from indoor tanning and indicated a lower likelihood of using indoor tanning in the future compared to control participants on the post-intervention assessment. No differences were found for sunburns.

Conclusions—The results of this pilot randomized controlled trial provide evidence that the indoor tanning intervention is acceptable to participants and may encourage cessation of indoor tanning behavior. The findings provide preliminary support for an indoor tanning intervention that engages tanners to challenge their beliefs about the benefits of indoor tanning. The use of a web-based indoor tanning intervention is unique and provides strong potential for dissemination.

Keywords

behavioral intervention; indoor tanning; melanoma prevention; skin cancer; prevention

Indoor tanning beds (IT) that emit artificial ultraviolet (UV) radiation are implicated in an estimated 450,000 cases of non-melanoma skin cancer and 11,300 cases of melanoma each year in the United States, Northern and Western Europe, and Australia (Wehner et al., 2012). In the United States, the increasing popularity of IT over the past 2 decades among young adult women (Robinson, Kim, Rosenbaum, & Ortiz, 2008) has been accompanied by increasing melanoma incidence in this group (Coelho & Hearing, 2010). Nearly 1 in 3 young adult Caucasian women report using IT in the past year (Guy, Berkowitz, Watson, Holman, & Richardson, 2013), making this an important group for melanoma prevention efforts.

The 2014 *Surgeon General's Call to Action to Prevent Skin Cancer* highlights the need for innovative IT behavioral interventions that address underlying motives for tanning including "the desire to look attractive and healthy and to conform to societal beauty standards" (U.S. Department of Health and Human Services, 2014). Body image theory may provide insights into developing such interventions. Body image theories posit that one's thoughts and actions related to their appearance are largely socially determined by perceptions of societal beauty standards, or beauty ideals (Stice, 2001; Thompson & Stice, 2001). This beauty ideal is further reinforced by interpersonal experiences. A young woman who internalizes the beauty ideal as her own appearance goal will feel pressured to match her appearance to them. Perceived discrepancies between the internalized ideal and one's appearance leads to body image dissatisfaction. Appearance-altering behaviors, like IT, become powerfully reinforcing because they help to alleviate body dissatisfaction by aligning one's appearance more closely with the ideal.

The application of body image theory to IT would suggest a young woman's societal experiences can lead her to form a tan beauty ideal, defined as the belief that being tan is a defining aspect of being an attractive woman. A young women who internalizes a tan ideal

will value being tan as important to her own attractiveness, be motivated to use IT, and experience appearance dissatisfaction when she is not tan. Evidence is beginning to emerge that supports an association between body image constructs and IT attitudes and behavior (see review by Thompson, Ata, Roehrig, & Chait, 2012). The desire to possess the same tan as favored celebrities, a marker of tan ideal internalization, is linked to IT among young adults (Cafri, et al., 2008). Also consistent with internalization, IT users monitor, evaluate, and compare their tan to their desired or ideal tan level (Cafri et al., 2008; Gillen & Markey, 2012; Prichard, Kneebone, Hutchinson, & Wilson, 2014). Appearance monitoring influences IT intentions through increasing body dissatisfaction (Stapleton, Turrisi, Todaro, & Robinson, 2009). Skin tone dissatisfaction, defined as perceived discrepancy between one's current and ideal tan, is associated with tan ideal internalization and tanning behavior among adolescent girls (Pritchard, et al., 2014). Body image investment in IT may explain why some users think the short-term appearance benefits and self-confidence gained with IT are more important than or worth the risks (Banerjee, Hay, & Greene, 2013; Cafri, Thompson, Jacobsen, & Hillhouse, 2009).

This study describes the pilot test of a web-based IT intervention informed by body image theory-guided interventions designed to prevent disordered eating among young women. The intervention targets an IT user’s perceptions of the benefits and value of tanning and addresses the role of body image in IT. The intervention was targeted to young women as they report the highest rates of IT. The intervention included persuasive techniques informed by non-clinical cognitive behavioral interventions that engage participants in reflection and cognitive restructuring of beliefs (Heinicke, Paxton, McLean, & Wertheim, 2007; Stewart, Carter, Drinkwater, Hainsworth, & Fairburn, 2001; Stice, Rohde, Durant, & Shaw, 2012). Psychoeducational content was designed to engage participants in reflecting on how their IT behavior may be influenced by their societal experiences related to tanning, the internalization of the value that a tanned appearance is an ideal body image, and resulting dissatisfaction. Restructuring IT-related beliefs involved thought exercises that presented tan ideal counter perspectives, including evidence against a tan beauty ideal as well as alternative viewpoints about the personal and social benefits of tanning. Participants were also encouraged to consider strategies for counteracting body dissatisfaction and plans for reducing their IT.

Several IT interventions with evidence of efficacy target perceptions of the short-term appearance benefits of IT through raising awareness of the negative appearance effects of IT (e.g., premature skin aging and wrinkling) (Hillhouse, Turrisi, Stapleton, & Robinson, 2008; Gibbons, Gerrard, Lane, Mahler, & Kulik, 2005; Greene & Brinn, 2003). This intervention shares important key features with these and other skin cancer intervention approaches (Jackson & Aiken, 2006; Lazovich et al., 2013; Mahler, Kulik, Butler, Gerrard, & Gibbons, 2008; Pagoto, Schneider, Oleski, Bodenlos, & Ma, 2010) including reframing perceptions of tanning benefits, targeting normative perceptions regarding the attractiveness of tanning, and promoting healthy alternatives to tanning. Innovative aspects of this intervention include the web-based format and the use of thought exercises to target central body image constructs including perceptions of a tan ideal, tan ideal internalization, and perceptions of the role of dissatisfaction in IT.

The first study aim was to describe the acceptability of the intervention as determined by participants' intervention evaluations. The second aim was to report the preliminary behavioral outcomes measured on a 6-week intervention follow-up assessment. The study hypothesis was that intervention participants would report less IT and a lower likelihood of using IT in the future at follow-up compared to control participants. We also examined whether rates of sunburns, a marker of IT and other risky UV exposure, were lower among intervention participants.

Method

Participants

Participants were females between the ages of 18 and 25 years old who had used IT in the past 12 months. Participants were recruited from a large northeastern United States university with posted study flyers or via in-class announcements in six courses. Study procedures were described as reviewing and providing feedback about an interactive website about tanning beds. A study coordinator screened and enrolled participants via phone. The 186 participants who completed a baseline assessment reported a mean age of 19.78 years (*SD* = 1.35) and their race was: White = 147 participants (79.0%), Asian = 20 (11.1%), Black = 2 (1.1%), Other = 11 (5.9%), or Refused = 6 (3.2%). Twenty-five participants identified as Hispanic (13.4%).

Study Design and Procedure

In this 2-arm randomized controlled trial, participants were randomized to an intervention condition or a waitlist control condition. Intervention participants completed a baseline assessment, viewed and evaluated the intervention approximately 2 weeks later, and then completed a follow-up assessment approximately 6 weeks after the intervention. Participants in the waitlist control condition completed the baseline and follow-up assessments and were invited to access the intervention after the follow-up. Deviations in this study timing occurred with some participants due to either: (1) a 2-week delay in the intervention and subsequent follow-up caused by issues related to intervention programming (n = 6), or (2) a follow-up assessment period that was shortened by 1 to 2 weeks to accommodate assigning extra course credit prior to the end of the semester (n = 6 intervention participants (8% of the intervention condition)). All participants provided online informed consent prior to the baseline and the University's Institutional Review Board approved all procedures.

Participants received a unique identification number to securely complete each assessment and the intervention. An introduction email provided study details and a link to the baseline assessment. As many as two email reminders were sent to non-completers. Participants who did not complete an assessment within 1 week of receiving the second email reminder were considered to be study dropouts. Baseline assessments were completed between December 2013 and March 2014 and follow-up assessments were completed between April and May of 2014. The study timing was planned so that the intervention would be administered prior to the winter months between February and April, which are considered to be the peak time for IT (Hillhouse et al., 2008). Flyer participants received a gift card for each completed assessment ($25) and the intervention evaluation ($20). Classroom participants received

extra course credit for completing assessments and a gift card for the intervention evaluation ($20). Incentives were paid immediately following participants' accessing the assessments, regardless of level of completion. Classroom participants were enrolled in a $100 gift card raffle at the end of the study contingent on completing all study procedures.

Intervention

The intervention was programmed with SNAP survey software (SNAP Surveys Ltd, 2012). The intervention was accessed as a URL website but participants were guided through webpages in a pre-determined order rather than having links that allowed them free exploration. Each page contained psychoeducational content or thought exercises with corresponding closed- or open-ended questions for providing brief, typed responses. Responses were securely saved and stored by the software program.

The intervention adapted a cognitive behavioral approach that engages IT users to reflect on and restructure their beliefs related to their personal and social valuation of tanning. Table 1 provides an intervention map with an overview of the intervention techniques, targeted constructs, and a brief description of associated content. Psychoeducational content engaged participants in reflecting on their IT-related beliefs and behaviors. Content discussed how media and peer experiences shape and reinforce their tanning beliefs (tan ideal) and how these beliefs can lead to an overemphasis on being tan (internalization) and body dissatisfaction. Restructuring IT-related beliefs involved thought exercises in which participants were provided with persuasive information that included presenting evidence against a tan beauty ideal as well as alternative viewpoints about the personal and social benefits of IT. The intervention provided counter perspectives to beliefs about a tan ideal in the media (i.e., the belief that tanning is common in attractive media figures) and in peers (i.e., the belief that peers greatly value being tan and IT), as well as reasons to not internalize the tan ideal. Participants were asked to consider these counter perspectives and to provide their thoughts and reactions to the information in the form of typed responses. Content related to media influences on body image was primarily adapted and informed from disordered eating interventions (Heinicke et al., 2007; Stewart et al., 2001; Stice et al. 2012). Counter perspectives from IT-using peers were derived from a focus group study with IT users (unpublished data). Specifically, focus group quotes were identified from instances of IT users talking about negative personal and social aspects of being a tanner.

Intervention participants who indicated an interest in changing their IT identified a tanning change goal and a change plan that included considering obstacles to changing, including internalization thinking, and strategies for dealing with these obstacles. Participants completed a top 10 list of their best personal attributes and were told to remind themselves of these attributes when experiencing body dissatisfaction in the future. Finally, participants were asked to consider alternative appearance behaviors that could be substituted for IT.

Acceptability Evaluation

Participants evaluated the intervention by rating it on 4 aspects: interesting, understandable, useful, and positive (Hillhouse et al., 2008). Item response options were an 11-point scale (0 = *not at all* and 10 = *extremely*). Participants provided an overall rating of the intervention

on a scale of 1 to 10 (1 = *I did not like this program at all* and 10 = *This is a wonderful program*) and indicated whether they would recommend the intervention to a friend if it were publicly available. Participants also provided open-ended feedback related to the aspects of the intervention they liked best and least. For both questions, two authors (masked) independently read and coded each response to identify the referenced best and least-liked intervention aspects. The authors compiled the codes into like responses and worked together to develop a consensus related to central themes that described the various types of comments.

Efficacy Evaluation Measures

Indoor tanning—IT was assessed following guidelines developed by a National Cancer Institute panel of IT researchers (Lazovich et al., 2008). In the baseline assessment, participants estimated the number of times they used a tanning bed or booth with tanning lamps in their lifetime and in the past 12 months with an open-ended response. In the follow-up assessment, this item stem was used with a past 6-week recall to reflect the period between intervention administration and the follow-up. Global measures of IT are highly correlated with bi-weekly diary measures of behavior collected within the same time frame (Hillhouse et al. 2008).

Likelihood of indoor tanning—On the follow-up assessment, participants indicated how likely they were to use IT in the next year on a 5-point response scale (0 = *not at all likely* and 4 = *very likely*) (Hillhouse et al., 2008).

Sunburns—On the follow-up assessment, participants indicated the number of sunburns they received in the past 6 weeks at follow-up with an open-ended response option. The sunburn measure is considered a general marker of UV risky behavior as the item does not specify whether the sunburn is a result of IT use.

Efficacy Evaluation Analytic Plan

A per protocol data (PP) analysis approach was used by analyzing data from only participants who completed all study procedures. PP is appropriate in assessments of pilot trials and preliminary intervention outcomes studies designed to determine the efficacy of an intervention when delivered on ideal conditions with study compliant participants (Armijo-Olivo, Warren, & Magee, 2009). Participants included in the PP analysis were compared to non-completers on important baseline variables to assess for evidence of study bias related to study dropout. There was little evidence that non-completers differed from study completers on mean levels of baseline lifetime number of tanning sessions ($t(183) = .216$, $p = .83$), number of past 12 month IT sessions ($t(179) = .040$, $p = .97$), and likelihood of IT ($t(184) = -1.71$, $p = .09$).

Intervention efficacy was assessed by comparing intervention and control participants on IT use, likelihood of using IT in the future, and sunburns reported at follow-up. The IT and sunburns outcomes are count variables and were analyzed using zero-inflated negative binomial (ZINB) regression models. Zero-inflated analyses were appropriate because of the high number of zero responses to both variables at the follow-up (63% *0* values for IT and

91% *0* values for sunburns). In addition, the count outcomes had standard deviations that were larger than the means (IT sessions $M = 3.33$, $SD = 6.65$; sunburns $M = 0.23$, $SD = 1.02$), which is indicative of overdispersion and the need for negative binomial modeling. Mean differences between conditions in likelihood of using IT in the future were examined with a linear regression model. All analyses were conducted with Mplus version 7.3 using maximum likelihood parameter estimates with robust standard errors (Muthén & Muthén, 2012).

Results

Participants

A screening phone call was conducted for 215 of the 272 individuals who contacted the research team about the study. Twenty-two individuals were screened as ineligible and the remaining 193 individuals agreed to participate and were enrolled. Six enrolled participants reported no past 12-month IT on the baseline despite indicating IT during the screening call. These ineligible participants were allowed to finish the study procedures but were excluded from the data analysis. A total of 187 eligible participants were randomized to the intervention (n = 94) or control (n = 93) condition (Figure 1). The majority of participants were recruited from classrooms (66%, n = 123). The mean number of baseline past 12 month IT sessions was similar for intervention ($M = 19.90$, $SD = 18.91$) and control participants ($M = 17.07$, $SD = 20.79$) ($t(179) = -0.96$, $p = .34$) as well as mean levels of IT likelihood (intervention $M = 2.33$, $SD = 1.43$; control $M = 2.14$, $SD = 1.42$) ($t(184) = -0.93$, $p = .36$).

Acceptability

Intervention evaluation—The means for the intervention evaluation items (measured on an 11-point scale with 0 = *not at all* and 10 = *extremely*) were: interesting 7.70 ($SD = 1.71$, *range* 2–10, *mode* = 8), understandable 8.94 ($SD = 1.31$, *range* 4–10, *mode* = 10), useful 7.89 ($SD = 1.66$, *range* 3–10, *mode* = 9), and positive 8.49 ($SD = 1.49$, *range* 5–10, *mode* = 10). The overall mean rating of the intervention was 8.50 ($SD = 1.48$, *range* 3–10, *mode* = 10), which was highly positive as '10' was the most favorable response option. Sixty-seven participants (81%) indicated they would recommend the intervention to a friend if it was publicly available.

Participant feedback—Participants' open-ended responses to the questions related to the best and least liked intervention aspects were coded and sorted into representative themes (Table 2). The best liked aspects of the intervention included: the informative content (mentioned in 34% of comments), the focus on media influences (28%), being encouraged to reflect on their positive attributes (19%), being encouraged to think about their tanning behavior (18%), and the quotes about tanning from other young women (9%). Participants also commented on aspects of the intervention approach (13%) including the use of open-ended questions, the use of images, and the length. The most common response to the least like question was that participants did not have a least liked aspect to note (19%). Other least liked aspects included the intervention contained inaccurate assumptions (9%), made participants feel pressured to change or plan change (8%), made participants think about the

risks of tanning (5%), or too much reading (5%). Finally, some participants did not like the repetitive nature of questions (19%), the length (13%), and the question response options (9%). Many of these criticisms appeared to pertain to the baseline survey assessment rather than the intervention.

Efficacy

Intervention participants reported an average of 2.54 IT sessions (*SD* = 6.39) during the 6-week follow-up period compared to 4.02 IT sessions (*SD* = 4.20) for control participants. We tested for intervention effects on the IT outcome using a ZINB model because of the large portion of zero responses. The excessive zeros are referred to as structural zeros and, within this context, represent a subgroup of participants not at risk for indoor tanning (i.e., they abstained from tanning) (Cheung, 2002). The 2-component ZINB model uses logistic regression to model the occurrence of structural zeros, or the non-tanning subgroup, and negative binomial regression to model the expected count or frequency of indoor tanning across the entire sample using all the responses (including zeros). The conditional means and variances of the negative binomial model component are altered to account for the probability of excessive zeros as obtained in the logistic model (Long, 1997). Both the logistic and binomial ZINB model components included intervention condition as a predictor and baseline number of past 12 month IT sessions as a covariate in an attempt to reduce variable overdispersion by accounting for individual differences in IT not accounted for by the intervention condition variable.

Results of the ZINB logistic model component (Table 3) showed that intervention participants were more likely to be in the non-tanning subgroup at follow-up compared to control participants ($\beta = 0.83$, $p < .05$). This beta estimate can be interpreted as the odds of reporting no IT at follow-up (i.e., abstaining from IT) were 2.29 times higher for intervention participants compared to the odds for control participants. For the ZINB count model component, there was a non-significant association between intervention condition and the frequency of IT sessions reported at the follow-up after accounting for the excessive zeros. This shows that the intervention did not reduce the frequency of IT sessions compared to the control condition after the model adjustments for the excessive zeros found in the sample. The baseline IT covariate was negatively associated with the structural zeros ($p < .001$) and positively associated with the frequency of follow-up IT sessions ($p < .001$).

With respect to the likelihood of future use of IT, intervention participants reported a significantly lower mean likelihood ($M = 2.15$, $SD = 1.47$) compared to control participants ($M = 1.50$, $SD = 1.30$) ($\beta = 0.65$, $p = .004$). For the sunburn ZINB model, neither the logistic or count component showed significant differences based on intervention condition.

Discussion

The purpose of this study was to evaluate the acceptability and preliminary impact of a web-based IT intervention. Findings showed high acceptability and preliminary evidence of intervention efficacy. In terms of acceptability, participants provided favorable evaluations of the intervention on several dimensions and a highly positive overall rating. The evaluations are comparable to those reported for an IT handbook intervention delivered to a

similar population (Hillhouse et al., 2008). Many participants felt the best part of the intervention was the content related to media influences and felt positively about reflecting on their IT. The high acceptability is an encouraging sign that IT users may be receptive to interventions that engage them to reflect on their IT behavior.

With regard to behavioral outcomes, the odds of not using IT at the follow-up were more than 2 times greater among intervention participants compared than the odds of abstaining among control participants. There were however no differences between intervention and control participants on the frequency of IT sessions during the follow-up period after accounting for the large number of abstainers. Thus, it appears the primary benefit of the intervention was in encouraging some intervention participants to abstain from IT. It is difficult to compare these outcomes to other trials that have demonstrated intervention efficacy using linear-regression based techniques (e.g., Hillhouse et al., 2008). Intervention participants also reported a low likelihood of using IT in the future compared to controls. Likelihood of future IT is an important measure of efficacy in this trial given the short follow-up period and the possibility that users may be hesitant to immediate give up their IT if they recently purchased monthly tanning packages. Future evaluation studies should utilize longer-term follow-up assessments to determine whether the reductions in IT use carry over to the following IT season. Sunburns are commonly reported with IT use (Stapleton et al., 2013) but our intervention did not lower sunburn rates. The lack of association may be due to the low number of reported sunburns or to the fact that the sunburn measure was not worded to specifically assess sunburns caused by IT.

Existing IT interventions target perceptions of the appearance benefits of tanning by raising awareness of the appearance damage caused by tanning. The current intervention shared important features with other approaches including providing contextual information about sociocultural influences and peer norms related to tanning, countering the perspective that tanned skin is healthy, providing examples of attractive women who are not tan, and promoting healthy appearance alternatives (Hillhouse et al., 2008; Lazovich et al., 2013; Pagoto et al., 2010). In the broader context of sun protection programs not targeted to IT users, other interventions have provided normative information (Reid & Aiken, 2013; Mahler et al., 2006) or addressed media pressures to be tan (Chait, Thompson, & Jacobsen, 2015). However, these non-IT targeted approaches have either not been evaluated for changes in IT or did not produce changes in IT. This intervention trial provides unique evidence of the efficacy of targeting central body image constructs including IT users' perceptions of a tan ideal, internalization of tanning as a critical component of their personal attractiveness, and the role of dissatisfaction in IT. The use of thought exercises, change plans and goals, and exercises to counteract body dissatisfaction are also unique intervention aspects that may have contributed to the intervention effects.

The intervention targeted IT users' beliefs about the tan ideal and tan ideal internalization. The finding that the intervention reduced IT behaviors supports a future trial designed to examine mediator variables corresponding to these attitudinal mechanisms of change. It is interesting that some participants' comments on the best aspects of the intervention included that the intervention led them to think more deeply about their tanning, their reasons for tanning, and the role of the media in tanning as well as the intervention's focus on

promoting positive body image. Many of the least favorable aspect comments were related to feeling that the assumptions of the intervention were “off” or that individuals did not want to consider changing their IT. These comments may be evidence of participant’s engaging in the type of self-reflection and challenging of body image beliefs designed to be produced by the intervention. Evidence for the feasibility of this approach would also be strengthened if a future study could demonstrate beneficial intervention effects among tanners with a high degree of baseline tan internalization or tanning body image investment.

This study extends the literature in important ways. The utilization of a web-based IT approach is novel and has strong potential for sustainable dissemination. In addition, web-based interventions are likely to appeal to the target audience of young adult women and could be extended to integrate social media, mobile technology, and other online content. This is the first intervention to demonstrate that targeting body image constructs and using related thought exercises can reduce IT. Future research should test whether the current approach improves on existing efficacious interventions for subgroups of tanners. For example, there is some evidence that existing appearance-focused interventions may be less efficacious among subgroups of tanners with high levels of pre-intervention knowledge about the appearance damage from IT (Stapleton, Turrisi, Hillhouse, Robinson, & Abar, 2010). It is possible that these subgroups hold the perspective that the appearance and confidence benefits of IT to be more important than or worth the risks (Banerjee et al., 2013; Cafri et al., 2009). The current intervention may be a more efficacious strategy for these tanners by attempting to reduce the perceived sociocultural, interpersonal, and personal benefits of tanning that seem to override the risks. It is important to test in future work whether intervention efficacy differs based on participants’ pre-intervention risk knowledge or tan ideal internalization. It is possible that intervention effects may be bolstered by tailoring content to participants’ baseline risk knowledge to provide a greater focus on perceived appearance benefits for participants with low risk knowledge.

This study has several limitations. Participants recruited to the study may be more likely to have motivation to change their IT practices compared to women who did not volunteer for this study. Future studies could use different recruitment methods to enroll less motivated tanners. Second, assessments were self-report. It is possible that the reporting of lower rates of IT by intervention participants were a result of socially desirable responding to appease researchers. Third, participants were provided strong incentives for participation. Future research is needed to determine the effectiveness of the intervention when delivered in a less controlled manner and with reduced incentives for participation. Finally, the study sample of young adult women was recruited from a single campus and was limited to past 12 month IT users. The extent to which the findings can be extrapolated to other populations and settings remains to be determined. A future intervention trial using IT non-users who intend to use IT would be valuable to test the effects of the intervention in preventing uptake of IT.

In conclusion, this study provides initial evidence that a web-based IT intervention that targets IT users’ body image-related beliefs is well-received and can produce reductions in IT. The preliminary behavioral outcomes are encouraging but there is a need to replicate findings and evaluate mediating mechanisms of intervention efficacy in additional studies. In addition, the adaptation of the intervention to a more traditional web format would

provide greater functionality and interactive components as well as flexibility in engaging participants through social media and other public formats. The findings provide initial evidence for a promising IT intervention approach with strong potential for dissemination and positive public health impact.

Acknowledgement

This research was supported in part by grants from the National Cancer Institute to Rutgers Cancer Institute of New Jersey (P30 CA072720) and from the National Cancer Institute to Jerod Stapleton (R03 CA165801 and K07 CA175115). The sponsors did not influence the design and conduct of the study, the collection, management, analysis or interpretation of the data, or the preparation, review, or approval of the manuscript. This article is dedicated to Damien Platt (@mymelanomafight). Damien continues to raise both awareness of the risks of tanning beds and funds for cancer research during his fight with stage 4 malignant melanoma.

References

Armijo-Olivo S, Warren S, Magee D. Intention to treat analysis, compliance, drop-outs, and how to deal with missing data in clinical research: A review. Physical Therapy Reviews. 2009; 14:36–49.

Banerjee SC, Hay JL, Greene K. Cognitive rationalizations for tanning-bed use: A preliminary exploration. American Journal of Health Behavior. 2013; 37:577–586. [PubMed: 23985280]

Boniol M, Autier P, Boyle P, Gandini S. Cutaneous melanoma attributable to sunbed use: Systematic review and meta-analysis. BMJ: British Medical Journal. 2012; 345

Cafri G, Thompson JK, Jacobsen PB, Hillhouse J. Investigating the role of appearance-based factors in predicting sunbathing and tanning salon use. Journal of Behavioral Medicine. 2009; 32:532–544. [PubMed: 19653089]

Cafri G, Thompson JK, Roehrig M, Rojas A, Sperry S, Jacobsen PB, Hillhouse J. Appearance motives to tan and not tan: Evidence for validity and reliability of a new scale. Annals of Behavioral Medicine. 2008; 35(2):209–220. [PubMed: 18365298]

Chait SR, Thompson JK, Jacobsen PB. Preliminary development and evaluation of an appearance-based dissonance induction intervention for reducing UV exposure. Body Image. 2015; 12:68–72. [PubMed: 25462883]

Cheung YB. Zero-inflated models for regression analysis of count study of growth and development. Statistics in Medicine. 2002; 21:1461–1469. [PubMed: 12185896]

Coelho SG, Hearing V. UVA tanning is involved in the increased incidence of skin cancers in fair-skinned young women. Pigment Cell & Melanoma Research. 2010; 23:57–63. [PubMed: 19968819]

Gibbons FX, Gerrard M, Lane DJ, Mahler HI, Kulik JA. Using UV photography to reduce use of tanning booths: a test of cognitive mediation. Health Psychology. 2005; 24:358. [PubMed: 16045371]

Gillen MM, Markey CN. The role of body image and depression in tanning behaviors and attitudes. Behavioral Medicine. 2012; 38:74–82. [PubMed: 22873732]

Greene K, Brinn LS. Messages influencing college women's tanning bed use: Statistical versus narrative evidence format and a self-assessment to increase perceived susceptibility. Journal of Health Communication. 2003; 8:443–461. [PubMed: 14530147]

Guy GP, Berkowitz Z, Watson M, Holman DM, Richardson L. Indoor tanning among young non-Hispanic white females. JAMA Internal Medicine. 2013; 173:1920–1922. [PubMed: 23959651]

Heinicke BE, Paxton SJ, McLean SA, Wertheim EH. Internet-delivered targeted group intervention for body dissatisfaction and disordered eating in adolescent girls: A randomized controlled trial. Journal of Abnormal Child Psychology. 2007; 35:379–391. [PubMed: 17243014]

Hillhouse J, Turrisi R, Stapleton J, Robinson J. A randomized controlled trial of an appearance-focused intervention to prevent skin cancer. Cancer. 2008; 113:3257–3266. [PubMed: 18937268]

Jackson KM, Aiken LS. Evaluation of a multicomponent appearance-based sun-protective intervention for young women: Uncovering the mechanisms of program efficacy. Health Psychology. 2006; 25:34. [PubMed: 16448296]

Lazovich D, Choi K, Rolnick C, Jackson JM, Forster J, Southwell B. An intervention to decrease adolescent indoor tanning: A multi-method pilot study. Journal of Adolescent Health. 2013; 52:S76–S82. [PubMed: 23601614]

Lazovich D, Stryker JE, Mayer JA, Hillhouse J, Dennis LK, Pichon L, Thompson K. Measuring nonsolar tanning behavior: Indoor and sunless tanning. Archives of Dermatology. 2008; 144:225–230. [PubMed: 18283180]

Long, JS. Regression models for categorical and limited dependent. Thousand Oaks, CA: Sage Press; 1997.

Mahler HI, Kulik JA, Butler HA, Gerrard M, Gibbons FX. Social norms information enhances the efficacy of an appearance-based sun protection intervention. Social Science & Medicine. 2008; 67:321–329. [PubMed: 18448221]

Muthén, LK.; Muthén, BO. Mplus user's guide. Los Angeles, CA: Muthén & Muthén; 2010.

Pagoto SL, Schneider KL, Oleski J, Bodenlos JS, Ma Y. The sunless study: a beach randomized trial of a skin cancer prevention intervention promoting sunless tanning. Archives of Dermatology. 2010; 146:979–984. [PubMed: 20855696]

Prichard I, Kneebone A, Hutchinson AD, Wilson C. The relationship between skin tone dissatisfaction and sun tanning behaviour. Australian Journal of Psychology. 2014; 66:168–174.

Reid AE, Aiken LS. Correcting injunctive norm misperceptions motivates behavior change: A randomized controlled sun protection intervention. Health Psychology. 2013; 32:551. [PubMed: 23646838]

Robinson JK, Kim J, Rosenbaum S, Ortiz S. Indoor tanning knowledge, attitudes, and behavior among young adults from 1988–2007. Archives of Dermatology. 2008; 144:484–488. [PubMed: 18427042]

Stapleton JL, Hillhouse J, Turrisi R, Robinson JK, Baker K, Manne SL, Coups EJ. Erythema and ultraviolet indoor tanning: findings from a diary study. Translational Behavioral Medicine. 2013; 3:10–16. [PubMed: 24073158]

Stapleton J, Turrisi R, Hillhouse J, Robinson JK, Abar B. A comparison of the efficacy of an appearance-focused skin cancer intervention within indoor tanner subgroups identified by latent profile analysis. Journal of Behavioral Medicine. 2010; 33:181–190. [PubMed: 20058183]

Stapleton J, Turrisi R, Todaro A, Robinson JK. Objectification theory and our understanding of indoor tanning. Archives of Dermatology. 2009; 145:1059–1060. [PubMed: 19770454]

Stewart DA, Carter JC, Drinkwater J, Hainsworth J, Fairburn CG. Modification of eating attitudes and behavior in adolescent girls: A controlled study. International Journal of Eating Disorders. 2001; 29:107–118. [PubMed: 11429973]

Stice E. A prospective test of the dual-pathway model of bulimic pathology: Mediating effects of dieting and negative affect. Journal of Abnormal Psychology. 2001; 110(1):124. [PubMed: 11261386]

Stice E, Rohde P, Durant S, Shaw H. A preliminary trial of a prototype internet dissonance-based eating disorder prevention program for young women with body image concerns. Journal of Consulting and Clinical Psychology. 2012; 80:907. [PubMed: 22506791]

Thompson, JK.; Ata, R.; Roehrig, M.; Chait, S. Tanning: Natural and artificial. In: Cash, TF., editor. Encyclopedia of Body Image and Human Appearance. London: Elsevier; 2012. p. 783-789.

Thompson JK, Stice E. Thin-ideal internalization: Mounting evidence for a new risk factor for body-image disturbance and eating pathology. Current Directions in Psychological Science. 2001; 10:181–183.

Wehner MR, Shive ML, Chren MM, Han J, Qureshi AA, Linos E. Indoor tanning and non-melanoma skin cancer: Systematic review and meta-analysis. British Medical Journal. 2012; 345

U.S. Department of Health and Human Services. The Surgeon General's call to action to prevent skin cancer. Washington, DC: U.S. Dept of Health and Human Services, Office of the Surgeon General; 2014.

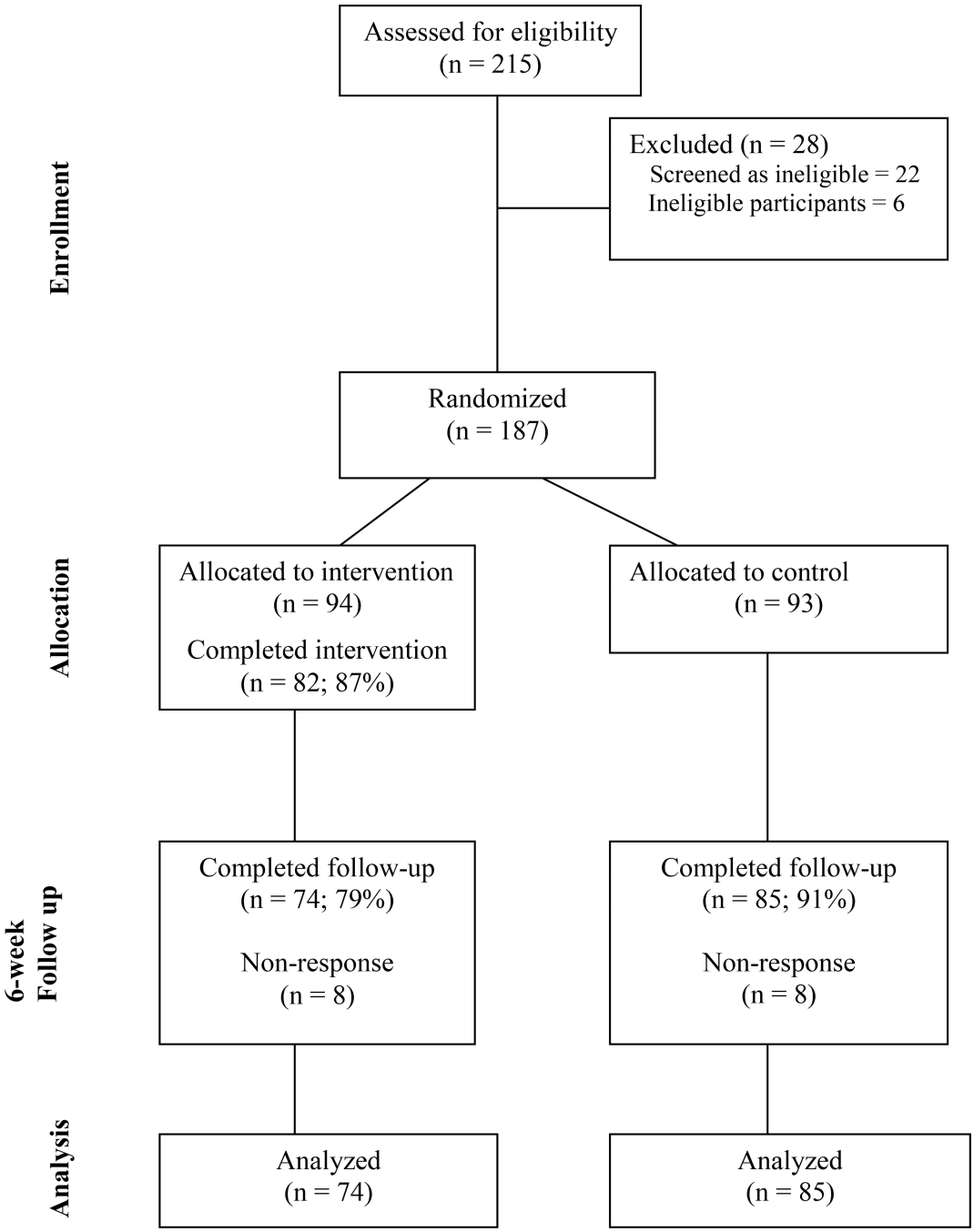

Figure 1.
Participant flow chart.

Table 1

Intervention Map of Techniques, Targeted Beliefs, and Brief Description of Intervention Content

Technique	Targeted Constructs	Description of content
Reflection	Societal influences that create and reinforce a tan ideal	Information about how young women's body image is influenced by media portrayals of attractive women that create beauty ideals and peer experiences that reinforce these ideals. Participants answer questions related to how media figures or peers influence their own IT.
	The process of internalization and resulting body dissatisfaction	Describes how endorsing the tan ideal can lead to feeling pressured to look tan and engender body dissatisfaction when not tan. Participants consider the role of negative mood resulting from body dissatisfaction on their own IT.
Restructuring	Beliefs about tan ideal in media	Encourage participants to consider examples of the many attractive celebrities who do not tan. Thought exercise related to a shifting societal view that is becoming more positive toward celebrities with natural, untanned appearances.
	Beliefs about internalization and resulting body dissatisfaction	Information about the prevalent use of digital image enhancement to create "perfect" images and examples of images with digitally enhanced tans. The use of enhanced images by IT salons to induce negative affect in IT users. Encourage participants to rethink the value of internalizing a tan ideal given the unrealistic nature of altered media portrayals and the risks of IT. Thought exercise related to their reaction to a task of comparing an unaltered image with an altered image of a popular celebrity. Listing of top 10 best personal attribute to counteract body dissatisfaction.
	Beliefs about tan ideal in peers	Thought exercises developed from a pre-intervention qualitative study with IT users. Examples included: considering the negative peer stereotypes associated with tanning; example of how being tan or using IT is not viewed positively by peers; the necessity of IT use because many peers do not pay attention to how tan their peers are; the view among peers and the college community that the perception of what is attractive is shifting away from tanning toward natural, untanned skin.
Strategies	Planning change and change goals	Describe an IT change goal and list steps for implementing a plan to achieve the change goal. Consider obstacles to changing IT and strategies for dealing with obstacles. Evaluate alternative behaviors to IT that have appearance-enhancing qualities.

Note. IT = indoor tanning.

Table 2

Thematic Categories of Participants' Best and Least Liked Intervention Aspects

Question	Themes	Illustrative quotes
Aspects of intervention liked best	Informative (34% of participants)	It really made me think about the harmful effects of tanning and brought to light that there are alternatives.
		The [intervention] was very informative and realistic about the consequences of tanning.
	Media influence focus (28%)	I especially like the photoshop portion. Girls don't realize that girls in magazines do not even look like that! It is an unachievable and unrealistic image.
		It reinforced the idea of why people go tanning, to gain a sense of attractiveness that the media instills. The media doesn't necessarily say, 'tan is attractive,' but rather if you do not try to be perfect and do not try to change the imperfections about yourself, you aren't beautiful.
		I liked how you can think critically about how the media actually affects you. I always knew that it was influencing me, but I never actually took the time to reflect on it consciously.
	Reflecting on positive attributes (19%)	It looked at the bigger picture, which was our self-esteem, confidence, how we feel about ourselves… a good reminder that each of us have a lot to be proud of and shouldn't worry solely about our appearance.
		[The intervention] made you come back to reality and show yourself how good of a person you truly are.
	Reflecting on positive attributes (19%)	I enjoyed that it really made you think hard about the reasons why I felt I needed to be tan.
		It made me think a lot about myself and how I compare myself to people.
	Quotes (9%)	I liked the quotes that were incorporated from real people in the program.
		[The quotes] really put things into perspective for me about what people think about tanning.
Aspects of intervention liked least	Incorrect assumptions (9%)	I didn't like that the program assumes that young girls go tanning because they are feeling down.
		I think your 'theories' might be a little too focused on the superficiality of tanning as opposed to other reasons people go tanning.
		The impression of thinking you just want to tan to impress people.
	Forced to consider changing behavior (8%)	They are trying to persuade me to change my tanning habits, but maybe I don't want to.
		What I liked the least was being forced to make goals. I don't really like people telling me what to do, especially because the program only knows so much about me.
	Raised risk awareness (5%)	I didn't like that this made me realize more about how bad tanning is for you….

Table 3

Comparison of Intervention Conditions on Behavioral Outcomes

	Intervention condition as predictor variable[a]			
Intervention follow-up outcomes	**β**	***SE***	***Z***	***p***
Indoor tanning sessions: Logistic model[b,c]	0.83	0.41	2.03	.042
Indoor tanning sessions: Count model[b,c]	−0.11	0.01	−0.37	.712
Likelihood of indoor tanning in the next year[d]	−0.65	0.22	−2.97	.003
Sunburns: Logistic model[b]	5.38	7.15	0.75	.452
Sunburns: Count model[b]	−0.14	0.84	−0.16	.871

Note. β = model beta estimate; SE = standard error for beta estimate; *Z* = z-test of ratio of estimate to standard error.

[a] The control condition is coded as the referent group for each model.

[b] Zero-inflated negative binomial model.

[c] Model component includes number of past 12 month IT sessions reported at baseline as a covariate.

[d] Linear regression model.