

Mindfulness-Based Interventions for Smoking Cessation in People with cancer: Insights from Qualitative Data

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Research Article

Keywords: smoking cessation, cancer care, mindfulness-based interventions, qualitative research, distress, stigma, identity, autonomy

Posted Date: October 14th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10856341/v1>

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Additional Declarations: No competing interests reported.

Abstract

Background

Continued tobacco use after a cancer diagnosis substantially worsens treatment outcomes and survival; yet, over 60% of people with cancer continue to smoke and fewer than 30% receive cessation support. Standard cessation approaches may fail to address the unique psychological context of cancer care, which includes cancer-related distress, perceived loss of autonomy, and heightened stigma. Mindfulness-based interventions (MBIs) are theoretically well-suited to address these mechanisms, yet have rarely been adapted to target the specific barriers to cessation in oncology settings.

Method

A subset of participants enrolled in CareConnect, a randomized clinical trial of tailored digital outreach for tobacco cessation in a racially and ethnically diverse sample of adult people with cancer who had cancer treatment within the past three months and completed semi-structured interviews ($N = 24$), 3 months to 1 year after receiving the outreach call to assess their experiences with the intervention. Thematic analysis was used to identify themes related to engagement with cessation support and how to apply these themes to mindfulness-based interventions.

Results

Thematic analysis revealed three primary themes maintaining tobacco use and limiting engagement with cessation: (1) autonomy threat and perceived judgment in cancer care; (2) cancer-related distress and treatment overload; and (3) shame, identity threat, and moralization of smoking. Together, these mechanisms constitute a reinforcing the nested Smoking-Distress-Avoidance Cycle in Cancer Care.

Conclusions

Findings are used to specify MBI components that map onto identified intervention targets. Implications for developing mindfulness-based interventions for individuals with cancer who smoke are discussed.

Introduction

Tobacco use among people with cancer remains a critical and underaddressed public health problem. Continued smoking after a cancer diagnosis is associated with worsened treatment efficacy, increased risk of secondary malignancies, and reduced overall survival (Cinciripini et al., 2024). Conversely, cessation at the time of diagnosis and during treatment has been shown to significantly improve survival outcomes and reduce the likelihood of cancer recurrence. Despite this, epidemiological data indicate that over 60% of people with cancer continue to smoke following diagnosis, and fewer than 30% receive

formal cessation support within the oncology care setting (Emmons et al., 2013; Jassem et al., 2019; Smith et al., 2019). Thus, there is a substantial treatment gap. While numerous evidence-based cessation pharmacotherapies and behavioral interventions exist, their uptake in oncology contexts remains limited. Structural barriers, including insufficient integration of tobacco treatment into cancer care workflows, low provider confidence in initiating cessation conversations, and competing clinical priorities partially account for this gap (National Cancer Institute, 2022). However, patient-level psychological and behavioral barriers are equally important and less well understood. Thus, closing the treatment gap will require not only structural solutions, but a clearer account of the mechanisms that maintain smoking and limit cessation engagement at the patient level.

Addressing these patient-level barriers requires a deeper understanding of the psychological mechanisms that maintain smoking in the specific context of cancer care. Cancer diagnosis and treatment create a profoundly altered psychological context, one characterized by existential threat, loss of bodily control, intensive medical demands, and heightened emotional burden (Bricker et al., 2023). Standard cessation approaches developed for the general population may be insufficient, or may even be counterproductive, when applied without adaptation to this population.

Cancer can create a unique psychological context that makes quitting especially difficult. Several theoretically grounded mechanisms have been proposed. First, the Common Sense Model of Illness Self-Regulation (Leventhal, 1980) suggests that illness threats activate cognitive and emotional representations that guide coping behavior. For people with cancer, this may include fatalistic illness beliefs (e.g., “It’s too late anyway”), perceived uncontrollability, and altered time perspectives that reduce the perceived urgency of cessation. Second, the Teachable Moment model (McBride et al., 2003) posits that acute health events increase risk salience and motivation for behavior change, implying that cancer diagnosis should increase quit motivation. However, this effect may be contingent on psychological resources and may be attenuated or overwhelmed by competing demands and distress. Third, research on illness stigma and identity threat (Knapp et al., 2014) suggests that illnesses perceived as controllable (such as smoking-related cancers) can trigger shame and identity-protective responses. When smoking is moralized in the context of cancer causation, cessation messages may elicit shame, self-blame, and avoidance rather than engagement. Together, these theoretical frameworks suggest that smoking in cancer care may be maintained through a cycle of distress, avoidance, and reinforcement. Yet the specific mechanisms driving this cycle, and their implications for intervention, have not been systematically examined through the perspectives of people with cancer themselves.

A growing consensus in behavioral medicine holds that intervention efficacy is enhanced when treatments are designed to target specific, theoretically grounded mechanisms of behavior change rather than behavior itself (Riddle et al., 2015; Sheeran et al., 2017). This principle underlies the NIH Science of Behavior Change (SOBC) experimental medicine framework, which calls for identifying and engaging mechanistic targets—measurable processes that are causally linked behavioral health/behavior change outcomes—early in intervention development, prior to efficacy testing (Onken et al., 2014). Applied to smoking cessation in cancer care, this framework suggests that improving

outcomes requires first identifying the mechanisms that maintain tobacco use in this specific clinical context, and then selecting or developing intervention components that demonstrably engage those targets.

Mindfulness-based interventions (MBIs) are a broad class of behavioral interventions grounded in the cultivation of present-moment, non-judgmental awareness. Several MBI modalities have been applied to smoking cessation in the general population, most notably Mindfulness-Based Relapse Prevention (MBRP; Bowen et al., 2011), which specifically targets automatic and reactive smoking through practices such as urge surfing and mindful awareness of craving. MBIs have also been widely applied to cancer-related distress, with Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1990) and related programs demonstrating efficacy for anxiety, depression, cancer-related fatigue, and quality of life in oncology populations.

Despite this, MBIs have rarely been adapted to target both smoking cessation and cancer-related distress simultaneously. An integrated MBI that addresses the specific psychological mechanisms driving smoking in cancer care could potentially increase both cessation treatment engagement and quit rates in this population. However, developing such an intervention requires a detailed understanding of the patient-level barriers and mechanisms that should be targeted.

The purpose of the present study was to use qualitative data from a subset of participants in the CareConnect randomized controlled trial to inform the development of a future mindfulness-based intervention for smoking cessation in cancer care. Consistent with the SOBC experimental medicine framework's emphasis on identifying mechanistic targets prior to intervention development, this study takes a formative approach, examining patients' own accounts of engagement and non-engagement with cessation support to (1) identify modifiable psychological mechanisms that maintain smoking in the cancer care context, and (2) specify which MBI components are best positioned to target these mechanisms. Findings are intended to directly inform the adaptation and design of an integrated MBI addressing both smoking cessation and cancer-related distress in this population.

Method

Parent Trial: CareConnect RCT. The present qualitative study was conducted as a nested substudy within the CareConnect randomized controlled trial (RCT; Clinical Trial Number and link: NCT05829824; Date: 4/13/23). In accordance with the Declaration of Helsinki, the study was approved by the IRB of the University of California, San Francisco. CareConnect contacted 1,777 adult oncology patients with documented tobacco use in the electronic health record (EHR) and an oncology-related clinical visit within the past month (Tsoh et al., 2026). Participants were randomized to one of two automated digital outreach conditions: (1) CareConnect ($n = 888$), which delivered tailored, autonomy-supportive educational messages about smoking cessation along with referral options; or (2) AutoReach ($n = 889$), an assessment-only automated outreach condition that also included referral options. Automated outreach was delivered in English, Spanish, Cantonese, and Mandarin. A total of 711

patients (CareConnect: n = 365; AutoReach: n = 346) completed the outreach call. Among these patients, 119 subsequently completed a follow-up survey 3 months to 1 year after the outreach call. Those who completed the survey were eligible for the qualitative study.

Qualitative Study Design and Participant Recruitment. The present qualitative study used a semi-structured interview guide designed to explore patient experiences with smoking during cancer care and perspectives on cessation support. Interviews were conducted via Zoom or telephone with a purposive subset of CareConnect participants.

To obtain a qualitative sample reflecting diverse intervention exposure and smoking-related experiences, 58 eligible participants were identified using a purposive sampling approach to maximize variation across across four characteristics: (1) outreach condition (CareConnect or Auto Reach); (2) language used for the automated outreach (English, Spanish, Cantonese or Mandarin); (3) use or nonuse of smoking cessation resources; and (4) smoking status at the 3-month follow-up (stopped cigarette smoking, continued smoking with a quit attempt or continued smoking without a quit attempt). Within these sampling criteria, participants were randomly selected for recruitment. Selected participants were contacted by telephone.

A total of 31 eligible participants were contacted for recruitment. Of these 24 agreed to participate in and completed a qualitative interview, one declined participation, and six did not respond to voicemail messages. Recruitment stopped once the target sample of 24 completed interviews was achieved. Participants whose preferred language was Cantonese, Mandarin, or Spanish were interviewed in those languages with the assistance of bilingual staff, and transcripts were translated into English for analysis. Participant characteristics, including demographics and clinical variables, were extracted from the EHR, with smoking status from the 3-month survey, and are included in Table 1.

Table 1
Patient Characteristics.

	N = 24	
	<i>N or Mean</i>	<i>% or SD</i>
Age (mean, SD)	61.29	10.83
Range	32–79	
Gender		
Woman	9	38%
Man	15	63%
Race & Ethnicity		
Non-Hispanic White	9	38%
Non-Hispanic Asian	5	21%
Non-Hispanic Black	3	13%
Hispanic or Latine	5	21%
Non-Hispanic AI/AN	2	8%
Interview Language		
Chinese (Cantonese/Mandarin)	2	8%
English	19	79%
Spanish	3	13%
Cancer Diagnosis		
Non-tobacco-related cancer	16	67%
Tobacco-related cancer	8	33%
Cancer Site—Tobacco related		
Lung/trachea	5	21%
Lip/oral cavity/pharynx	1	4%
Colorectal	1	4%
Urinary bladder	1	4%
Cancer Treatment, Past 3 Months*		
Chemotherapy	6	25%
*Categories are not mutually exclusive. Smoking status was derived from the 3-month survey.		

	N = 24	
	<i>N or Mean</i>	<i>% or SD</i>
Radiation	5	21%
Surgery	3	13%
Other treatment	15	63%
Smoking Status		
Smoking every day	9	38%
Smoking some days	6	25%
Not smoking, past 30 days	9	38%
*Categories are not mutually exclusive. Smoking status was derived from the 3-month survey.		

[Insert Table 1 about here]

Interview Procedure. A semi-structured interview guide was developed by the research team to elicit participant perspectives on: reactions to the outreach messages received in the parent trial, attitudes toward smoking cessation in the context of cancer treatment, experiences with cessation attempts, perceived barriers and facilitators to quitting, and interest in different forms of cessation support. The guide used open-ended questions to allow participants to describe their experiences in their own words, with probes to encourage elaboration. Interviews were audio-recorded with participant permission, professionally transcribed, and verified for accuracy. Interviews were an average of 60 minutes (range: 35–90 minutes).

Data Analysis

Transcripts were analyzed using thematic analysis following the framework described by Braun and Clarke (2006). Analysis proceeded through iterative phases: (1) familiarization with the data through repeated reading; (2) initial coding using an inductive approach to identify patterns in the data; (3) searching for themes by grouping related codes; (4) reviewing and refining themes; (5) defining and naming themes; and (6) producing the final analysis. Themes were then organized into higher-order mechanism clusters based on shared psychological processes. A second coder independently coded a subset of transcripts to assess analytical consistency, and discrepancies were resolved through discussion with the team.

Results

Participant characteristics are reported in Table 1. Thematic analysis identified three higher-order mechanism clusters, each integrating several inductive subthemes (Table 2). These clusters reflected

distinct but interrelated psychological processes regarding smoking behavior and engagement with cessation support in the context of cancer care. Each cluster is described below with supporting participant quotations provided in Table 3. A visual summary of these mechanisms and their relationship to smoking behavior is presented in the *Smoking-Distress-Avoidance Cycle* model described in the discussion following the thematic findings.

Table 2
Thematic Mechanism Clusters, Sub-Themes, and Behavioral Relevance

Cluster	Sub-Themes	Behavioral Relevance
Cluster 1. Autonomy Threat in Cancer Care	Theme 1: Loss of Control; Theme 2: Feeling Judged vs. Feeling Seen	Factors Affecting Engagement
Cluster 2. Cancer-Related Distress and Treatment Overload	Theme 3: Competing Priorities in Cancer Care; Theme 4: Smoking as Coping with Cancer-Related Distress	Mechanisms Maintaining Smoking & Engagement Capacity
Cluster 3. Shame, Identity Threat, and Moralization	Theme 5: Ambivalence Toward Cessation Support Theme 6: Identity and Self-Perception	Avoidance of Engagement
<i>Note.</i> Clusters were derived from inductive thematic analysis of semi-structured interviews with patients receiving cancer care who smoke (N = 24). Sub-themes are ordered within each cluster by conceptual relevance.		

Table 3
Representative Participant Quotations by Thematic Cluster and Sub-Theme.

Cluster	Sub-Theme	Illustrative Quotation(s)
Cluster 1. Autonomy Threat in Cancer Care		
	Theme 1: Loss of Control	<i>"The most important thing [was] ... I need to have agency around quitting. I needed to have agency in making those decisions, because during cancer treatment—having diagnosis and having cancer, you know, you're—you're not in control of anything in your body. So, I felt like that was the only thing I could do that demonstrated, 'Yes, I still have control, over this.'"</i>
		<i>"...I do not believe that somebody can help me to make my decision... Maybe somebody else, they need some kind of support. They need somebody to help them, but not me."</i>
	Theme 2: Feeling Judged vs. Feeling Seen	<i>"To me, it's important not to be treated as a dying piece of garbage. Sometimes I can feel it [from cancer care providers]. For me it's important to be treated as a person."</i>
		<i>"I don't mind hearing about quitting, but I feel that connecting cancer to smoking is blaming them for their cancer and they already get this judgement in society."</i> <i>"It's connecting, uh, like, having cancer to the fact that I was a smoker. It's not that I have lung cancer either, but, you know, it's still something I already get from society."</i>
Cluster 2. Cancer-Related Distress and Treatment Overload		
	Theme 3: Competing Priorities in Cancer Care	<i>"I have to worry about how I'm getting to chemo and how I'm paying for my rent before I can worry about a cigarette."</i> <i>"Oh, I got more, I have bigger fish to worry about. Than just a cigarette."</i>
		<i>"...there's so many things that pull attention away [in cancer care] and, uh, are demand attention at the moment ... I kind of have too much on plate and then get burned out, and just say, 'Forget it all.'"</i> <i>"Like, in the moment when I got the [CareConnect] call, because I was still trying to get my [cancer treatment] procedures and stuff, and so I was, like, already kind of scared...it kind of compounded to my stress a little bit, because I'm like, 'Oh, god, yeah, now I really got to deal with this [quitting] too"</i>
	Theme 4: Smoking as Coping with Cancer-Related Distress	<i>"...thinking 'Oh my God, I have cancer ... They're saying it's bad. Look, I need to go have another cigarette.' It's what I think."</i>
		<i>"When I start thinking about the cancer and the quitting, I get so anxious I just end up lighting another one."</i>
Note. N = 24. Ellipses indicate minor omissions for readability. Bracketed text indicates researcher clarification.		

Cluster	Sub-Theme	Illustrative Quotation(s)
		<i>"Of course, with the cancer diagnosis, if you're a smoker, that's just well enough. First thing you do is reach for a cigarette..."</i>
Cluster 3. Shame, Identity Threat, and Moralization		
	Theme 5: Ambivalence Toward Cessation Support	<i>"It's my, uh, preconceived notion that they're going to come at you hard with a lot of redundant lingo and it's like I don't have time for that...I try to avoid things like this, even [if I] have a feeling it might rub me wrong. That's all."</i>
		<i>"The only problem there is all the resources that came, came to me, I've already tried ... 'Been there, done that,' etcetera, etcetera. It didn't help before. It's not going to offer anything now. I'm always looking for a new approach, you know? Like, something that's going to work."</i>
	Theme 6: Identity and Self-Perception	<i>"...this judgmental vibe of having cancer because I'm a smoker ... It just made me do a lot of self-blame that I didn't want them to do. And so, the fact that my providers never talked about quitting smoking was a good thing for me."</i>
		<i>"...reality really hits you. It's really hard when you're going through it ... you've been smoking for so long, you know, and it's a part of your life. And to have to give it up. Then, to have to hear like, 'Oh, you know, it's, you could get more cancer if you don't stop'...it's just the harsh reality."</i>
Note. N = 24. Ellipses indicate minor omissions for readability. Bracketed text indicates researcher clarification.		

[Insert Table 2 about here]

Cluster 1: Autonomy Threat in Cancer Care

Theme 1: Loss of Control. Cancer diagnosis and treatment were described by participants as profoundly disempowering experiences. The intensive medical demands, loss of bodily agency, and structural constraints of cancer care (including decisions about treatment, scheduling, and hospital-based routines) created a pervasive sense of loss of control.

In this context, smoking sometimes became one of the few remaining choices that participants felt they could make for themselves. A striking pattern emerged in which the loss of control associated with cancer and other co-occurring health conditions paradoxically increased both the emotional valence of smoking as an autonomous behavior and, for some participants, the motivation to quit. At the same time, tobacco cessation advice delivered within the healthcare context could feel like yet another imposed demand, potentially generating psychological reactance. Participants described feeling worn down by the healthcare system and, at times, like “a number” rather than a person, which reinforced the psychological significance of maintaining choices that felt personal.

Theme 2: Feeling Judged Versus Feeling Seen. Closely related to the autonomy theme, participants described experiences of feeling judged or blamed by healthcare providers in the context of smoking. This was not limited to explicit cessation conversations; rather, it reflected a broader experience of moral appraisal embedded in the healthcare encounter for cancer care. These experiences of perceived judgment served as a significant barrier to engagement with cessation support, as patients who felt morally evaluated were less likely to report voluntarily seeking out or accept cessation services. The flipside of this pattern was that participants who described feeling genuinely seen and respected by their care teams expressed greater openness to cessation conversations.

[Insert Table 3 about here]

Cluster 2: Cancer-Related Distress and Treatment Overload

Theme 3: Competing Priorities in Cancer Care. A recurring pattern across interviews was the experience of cancer treatment as cognitively and emotionally overwhelming.

Participants described being occupied with managing treatment logistics, navigating financial strain, coping with physical side effects, and maintaining family and work responsibilities.

In this context, smoking cessation was frequently described as a low-priority concern relative to the demands of cancer treatment. This theme highlights an important constraint on cessation engagement that is structural as well as motivational: even participants who expressed a desire to quit frequently lacked the cognitive and emotional bandwidth required to engage in a behavior change program during cancer care. Further, structural constraints such as surgeons requiring smoking cessation to perform treatment may encourage cessation, whereas during post-surveillance or ongoing treatment for metastatic disease may present more challenges, suggesting that interventions may need to be tailored to phase of treatment.

Theme 4: Smoking as Coping with Cancer-Related Distress. Participants described smoking as a primary coping mechanism to reduce stress and for the fear, anxiety, and existential uncertainty associated with cancer diagnosis and treatment. Smoking provided short-term relief from distress and, as noted above, a sense of agency. A particularly important dimension of this theme was the perception that quitting would remove a critical coping resource at the moment of greatest need. Several participants described a form of harm reduction reasoning: that preserving their mental health and emotional stability during cancer treatment was a higher priority than smoking cessation, and that quitting at this time might worsen their psychological functioning. This belief, while understandable in context, often served to indefinitely defer cessation attempts.

Cluster 3: Shame, Identity Threat, and Moralization

Theme 5: Identity and Self-Perception. Cancer diagnosis disrupted participants' self-concepts in ways that intersected with the identity implications of smoking. Several participants described a strong investment in being what they perceived as a good patient—someone who was responsible, compliant with medical advice, and doing everything possible to improve their health. The presence of ongoing smoking created cognitive dissonance with this identity. This identity threat was particularly salient for participants with non-tobacco-related cancers, who were especially sensitive to any implication that their smoking was causally related to their diagnosis. Even for those with tobacco-related cancers, the identity stakes of smoking were heightened in a medical context in which patients were hyperaware of being observed and evaluated.

Theme 6: Stigma and Self-Blame. Participants described heightened stigma surrounding smoking after cancer diagnosis. Cessation messages that highlighted the negative impact of continued smoking on cancer treatment outcomes—while clinically accurate—were sometimes experienced as accusatory. Rather than motivating behavior change, these messages could trigger shame, denial, and self-blame. Responses to perceived stigma included avoidance of cessation conversations, reluctance to seek help, and minimization of smoking to protect self-esteem. These responses highlight the potential for well-intentioned health messaging to backfire when not delivered in a shame-sensitive, non-judgmental manner.

Discussion

This study used qualitative interviews with patients with cancer who use tobacco to identify the psychological mechanisms that maintain tobacco use and limit engagement with cessation support in oncology settings. Three higher-order mechanism clusters were identified: 1) autonomy threat, (2) cancer-related distress and treatment overload, and (3) shame and identity threat. Together, these may contribute to a self-reinforcing Smoking-Distress-Avoidance Cycle specific to the cancer care context.

An Integrative Model: The Smoking-Distress-Avoidance Cycle

Taken together, the three mechanism clusters describe a reinforcing cycle specific to the cancer context. We term this the *Smoking-Distress-Avoidance Cycle* (Fig. 1). Cancer diagnosis activates cancer-related distress (fear, uncertainty, existential threat) and overwhelm with treatment demands; as well as cognitive rationalizations or compartmentalization (e.g., “*It’s too late anyway*”; “*At least I don’t have lung cancer*”). Patients cope with this distress through smoking, which provides temporary relief and reinforces a sense of agency. However, smoking in the context of cancer also elicits guilt and shame, which can trigger avoidance of cessation services and cognitive dissonance. This avoidance allows smoking to continue and, by interfering with cessation engagement, ultimately increases health risk and distress—reinforcing the cycle.

[Insert Fig. 1 about here]

This model conceptualizes the cancer-specific mechanisms as an outer layer that intensifies and contextualizes the general negative reinforcement cycle common to all smokers (i.e., craving; smoking; relief; reinforcement). The cancer context amplifies the emotional salience of smoking, introduces additional stigma and identity-related barriers, and creates specific cognitive rationalizations that are not present, or are less salient, in the general population.

Mindfulness Intervention Components: Matching Skills to Mechanisms

These findings could have direct implications for how cessation interventions should be designed, delivered, and adapted for this population, and specifically for how MBIs can be tailored to address the identified targets (see Fig. 2). Specifically, findings of the present study provides a template for exploring which MBI components are most likely to be effective for people with cancer who smoke, and at which points in the cessation pathway they should be applied.

[Insert Fig. 2 about here]

Distress tolerance and emotion regulation. For patients in whom cancer-related distress maintains smoking as a coping strategy, interventions need to address the emotional regulatory function of tobacco use. MBSR practices such as mindful breathing, body scan, and grounding techniques from Dialectical Behavior Therapy (DBT; Linehan, 1993) can directly build distress tolerance capacity. Providing alternative coping strategies for cancer-related distress—rather than simply removing the smoking behavior—is likely to be essential for this subgroup.

Urge surfing and craving awareness. MBRP-derived urge surfing techniques (Bowen et al., 2011) are well-suited to disrupt the automatic link between distress and smoking. By cultivating the capacity to observe cravings and negative emotions without immediately acting on them, urge surfing can weaken the short-term negative reinforcement that maintains the cycle. This technique targets the moment of transition between distress arousal and smoking behavior—the most proximal intervention point in the cycle.

Cognitive de-fusion and values clarification. For patients who maintain smoking through cognitive rationalizations (e.g., fatalism, competing priorities), Acceptance and Commitment Therapy (ACT)-derived cognitive defusion techniques (Hayes et al., 1999) may help patients observe these thoughts without being governed by them. Values clarification exercises can help patients reconnect smoking cessation with personally meaningful life goals that remain relevant despite—and often because of—a cancer diagnosis, providing intrinsic motivation for change that is autonomous rather than externally imposed.

Present-moment awareness and acceptance. The cancer context often creates a disrupted relationship with time, with patients oscillating between preoccupation with future health outcomes and avoidance of

present experience. Present-moment awareness practices can support patients in engaging with the current moment, including the reality of their health situation, in a way that is stabilizing rather than overwhelming. Acceptance practices can help reduce the existential distress that drives smoking as avoidance coping.

Self-compassion and loving-kindness practices. For patients who experience shame, self-blame, and stigma, self-compassion practices (derived from both MBSR and Metta, or loving-kindness meditation; Frederickson et al., 2008) may be particularly important. Research on self-compassion suggests that it reduces defensiveness and shame-driven avoidance and increases willingness to acknowledge and address personal difficulties (Neff, 2003). In the cessation context, self-compassion may support patients in approaching cessation as an act of care for themselves rather than compliance with an externally imposed demand.

Implications for Intervention Delivery

Beyond the content of MBI components, the current findings have implications for how cessation support can be framed and delivered to people with cancer. Autonomy-supportive communication styles, which have been shown to improve engagement with health behavior change, may be particularly important in this context. Thus, cessation support may benefit from framing in terms of patient values and goals, rather than obligation or compliance, and delivered in a way that explicitly acknowledges and validates the competing demands and emotional burdens of cancer care.

The findings also suggest that cessation support should be destigmatized and normalized within oncology settings. Routine integration of brief cessation support into oncology appointments, paired with non-judgmental communication training for oncology providers, may reduce the shame-avoidance barrier. Finally, the treatment overload theme suggests that cessation interventions should minimize burden and maximize accessibility, for instance through digital or smartphone-based delivery.

Strengths and limitations

The study has several notable strengths. The sample was racially and ethnically diverse, and data collection was conducted in English, Spanish, Cantonese, and Mandarin, thereby enhancing the breadth of perspectives captured and the potential applicability of findings across communities disproportionately affected by tobacco-related cancers. The qualitative study was nested within a large, well-characterized RCT (N = 1,777), providing a clearly defined sampling frame and enabling the qualitative findings to be interpreted alongside known trial outcomes. Purposive sampling was used to maximize variation across key dimensions, including randomization condition, smoking status and related experiences, cancer type, and demographics. Finally, the thematic findings were grounded in and theoretically integrated with established frameworks from health psychology, lending conceptual coherence to the resulting mechanism model and its intervention implications.

Several limitations also warrant mention. First, the qualitative sample was drawn from a single, highly resourced comprehensive cancer center in Northern California, which may limit the generalizability of findings to patients receiving care in other geographic regions, community-based settings, or under-resourced health systems. Patients in these settings may differ from those represented in the present sample in characteristics relevant to smoking cessation experiences, including insurance status, health literacy, and social support, from those treated in community oncology settings, limiting generalizability. Second, participants were recruited from a larger RCT of a specific digital outreach intervention, who may differ from the broader population of patients with cancer who smoke in their willingness to engage with research or cessation-related outreach. Third, the interviews were at a single time point, and therefore cannot capture longitudinal changes in smoking motivation or cessation engagement across the cancer treatment trajectory. Future research should examine how the mechanisms identified here vary across the cancer treatment timeline, from diagnosis through active treatment, post-treatment surveillance, and survivorship or recurrence, as the salience of different barriers may shift substantially at each stage.

Conclusions

Smoking while receiving cancer care is not simply a matter of addiction. While it shares common themes across all people who smoke, it also reflects a complex psychological cycle involving loss of autonomy, cancer-related distress, treatment overload, shame, and identity threat. Standard cessation approaches may be insufficient, or may inadvertently exacerbate these barriers, if they do not account for the specific psychological context of oncology care. The present study provides an empirically grounded framework for understanding how distress, avoidance, and tobacco use may interact in this context and identifies candidate mechanisms that can be tested in future research and targeted through intervention development. Mindfulness-based interventions are uniquely positioned to address this cycle, offering a suite of evidence-based practices that can target distress tolerance, automatic smoking, cognitive rationalization, and shame, which may act as core drivers of the Smoking-Distress-Avoidance Cycle identified herein. These findings therefore provide a foundation for the systematic development and refinement of mechanism-targeted interventions and for testing whether changes in the identified mechanisms lead to improved tobacco cessation support engagement and outcomes. Future research should evaluate both the proposed mechanisms and the efficacy of mechanism-informed, adapted MBIs in this population, with the ultimate goal of improving both cessation support engagement and cessation outcomes for people with cancer who smoke.

Declarations

Declarations

Consent to participate. Informed consent was obtained from all individual participants included in this study as part of their enrollment in the parent CareConnect trial. *Consent to publish.* Not applicable. This

manuscript does not include any images, names, or other identifying information about participants. All quotations are de-identified.

Funding:

This research was funded by the California Tobacco-Related Disease Research Program (TRDRP) T32IP4743 (PI: Janice Y. Tsoh) and the National Institute on Drug Abuse (NIDA) T32DA007250 (PI: Satre & Tsoh). Dr. Van Doren was supported by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) K23AA033108. The authors report no conflicts of interest with tobacco, pharmaceutical, or non-pharmaceutical nicotine product industries.

Author Contribution

N.V.D. and J.Y.T. conceptualized the study, developed the mindfulness model, analyzed the qualitative data and wrote the manuscript. K.S. assisted with qualitative analysis. K.S., E.Y., C.O., M.C.K., and J.Y.T. conducted the interviews. Z.L., C.M., and L.B.H. assisted with running and coordinating the original RCT across clinical sites. All authors (N.V.D., K.S., E.Y., C.M., C.O., M.C.K., Z.L., L.B.H., S.B., C.A., P.H., L.K., S.S.Y., and J.Y.T.) reviewed, edited, and approved the final manuscript.

Data Availability

The qualitative data generated and analyzed during the current study (full interview transcripts) are not publicly available due to patient confidentiality and privacy restrictions outlined in the informed consent. De-identified excerpts or coding frameworks are available from the corresponding author upon reasonable request and with appropriate institutional data-sharing approval.

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Figures

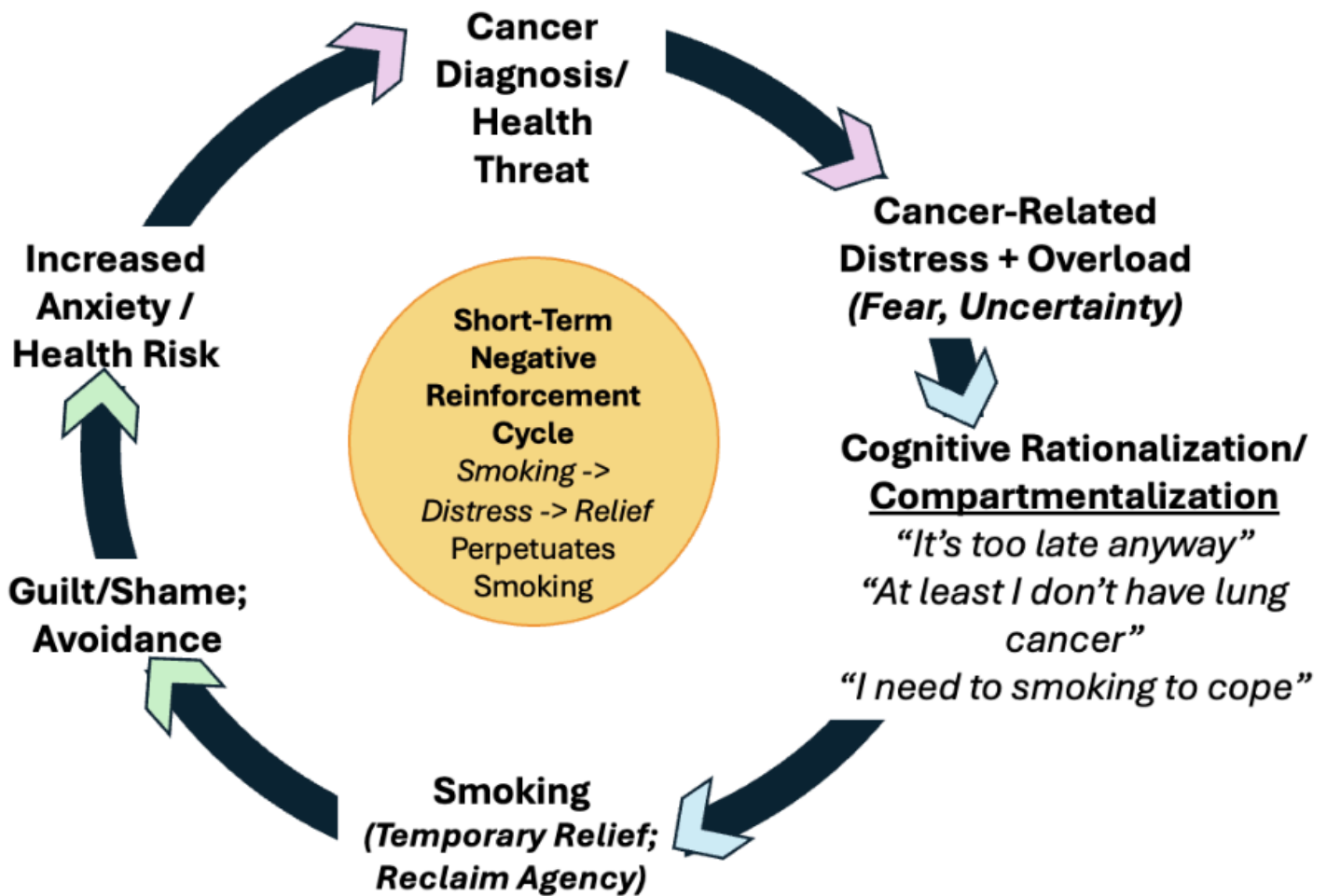


Figure 1

The Nested Smoking-Distress-Avoidance Cycle in Cancer Care. The proposed model illustrates how cancer-related experiences may interact with, amplify and perpetuate the negative reinforcement mechanisms that maintain smoking behavior. The model consists of two nested cycles. The inner circle represents the core underlying short-term negative reinforcement mechanism: distress prompts smoking, smoking provides temporary relief, and this relief reinforces continued smoking as a response to subsequent distress, which is common to tobacco dependence broadly. The outer cycle depicts the cancer-specific psychological processes that interact with, amplify and perpetuate this core reinforcement cycle. Cancer-related distress and treatment overload (fear, uncertainty) activates cognitive rationalization and compartmentalization (e.g., fatalistic beliefs, minimization), which drives smoking for temporary relief and perceived agency reclamation. Smoking is subsequently followed by guilt, shame, and avoidance of cessation support, which sustains the cycle and increases anxiety and health risk. Such guilt and shame are further amplified within the context of having cancer. Together, the nested cycles illustrate how a core distress-smoking-relief pathway may become embedded within a broader cancer-specific cycle of distress, cognitive rationalization, perceived agency reclamation, guilt and shame, and avoidance. The model proposes that cancer does not simply add another source of distress to the established negative reinforcement cycle of tobacco dependence; rather, the cancer

context could introduce pathways that interact with, amplify, and substantiate the core cycle of tobacco dependence, resulting in additional barriers to tobacco cessation. Each color of the arrows represents different stages of the cycle.

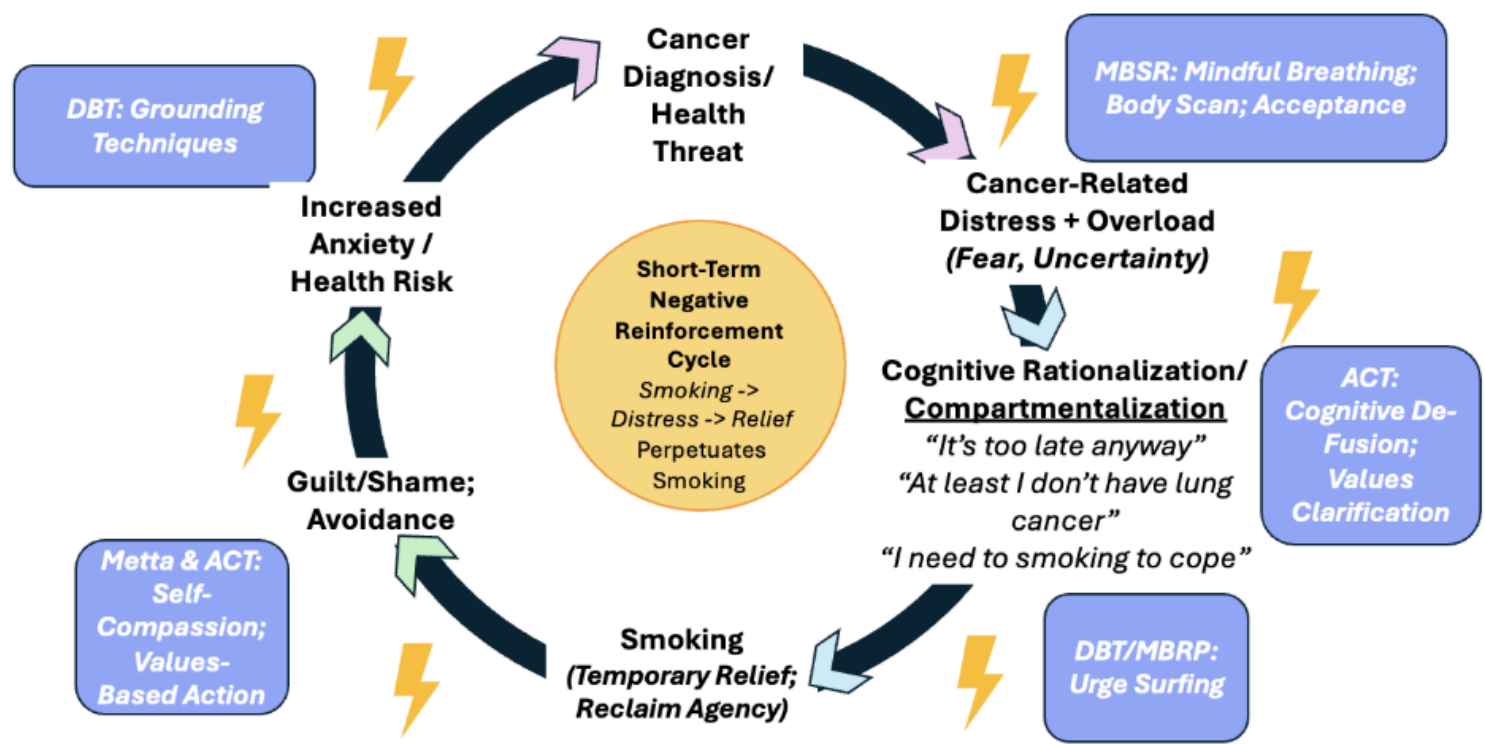


Figure 2

Mindfulness-Based Intervention Targets Mapped onto the Smoking-Distress-Avoidance Cycle. The Smoking-Distress-Avoidance Cycle (see Figure 1) with added proposed mindfulness-based intervention (MBI) components mapped onto each stage of the cycle. Lightning bolt icons indicate theorized points of intervention. Mindfulness-Based Stress Reduction (MBSR) practices (mindful breathing, body scan, and acceptance) target cancer-related distress and support emotion regulation regarding treatment overload. Acceptance and Commitment Therapy (ACT) cognitive de-fusion and values clarification target fatalistic cognitive rationalization and compartmentalization. Dialectical Behavior Therapy (DBT)/Mindfulness-Based Relapse Prevention (MBRP) urge surfing targets the transition from distress to smoking by building tolerance for craving without acting. Metta and ACT self-compassion and values-based action target guilt, shame, and cessation avoidance. DBT grounding techniques target the downstream escalation of anxiety and health risk. Together, these components provide a mechanism-matched intervention framework for adapting MBIs to the specific psychological context of smoking cessation in cancer care.

Supplementary Files

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