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Stigma and Health-Related Adjustment in Lung Cancer Patients: A Longitudinal Analysis of Moderators and Mediators

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Stigma and Health-Related Adjustment in Lung Cancer Patients:

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ABSTRACT OF THE DISSERTATION

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Timothy John Williamson

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Professor Annette Louise Stanton, Chair

Stigma and discrimination confer risk for poor mental and physical health for lung cancer patients, and research is needed to understand how and for whom stigma and discrimination are associated with poorer health-related adjustment. Although research has consistently demonstrated that the majority of lung cancer patients report experiences of stigma, longitudinal studies are needed to assess temporal relationships between lung cancer stigma and health-related adjustment. Additionally, no study has tested the unique contributions of lung cancer stigma and discrimination on psychological and physical health-related outcomes. Study 1 examined internalized lung cancer stigma (i.e., feelings of guilt, shame, and self-blame about one's lung cancer diagnosis) and perceived subtle discrimination (i.e., perceptions of unfair treatment due to one's lung cancer status that are ambiguous or low in intensity) as predictors of psychological and physical health outcomes across 12 weeks in 101 men and women on active

treatment for lung cancer (any stage, any diagnosis duration). Based on theory and evidence, Study 2 tested whether sleep disturbance mediated relationships between lung cancer stigma and discrimination with poorer health-related adjustment in the same sample of lung cancer patients. Participants completed questionnaires at study entry and at 6- and 12-week follow-up.

Findings from Study 1 indicated that internalized stigma and perceived subtle discrimination were uniquely and significantly associated with worse global quality of life and poorer psychological outcomes at study entry. Internalized stigma also predicted significant declines in global quality of life and increases in depressive symptoms and anxiety across time. Overall, the pattern of findings indicated that higher internalized stigma was a robust and independent predictor of declines in health-related outcomes across 12 weeks, whereas perceived discrimination was not. Study 1 also tested whether protective psychological processes (i.e., self-compassion, coping strategies) attenuated significant relationships between stigma and discrimination with health outcomes. Higher self-compassion and lower avoidant coping significantly moderated relationships between stigma and discrimination and psychological health. Specifically, when self-compassion was relatively high and avoidant coping was relatively low, internalized stigma and discrimination were not associated significantly with poorer psychological health. When self-compassion was relatively low and avoidant coping was relatively high, however, higher internalized stigma and higher perceived discrimination were associated with higher depressive symptoms and cancer-related anxiety, respectively.

Results from Study 2 demonstrated that lung cancer patients evidenced prominent sleep disturbance, as measured through subjective and objective measures. Perceived subtle discrimination (but not internalized stigma) was associated significantly with higher subjective sleep disturbance at study entry and across time, and subjective sleep disturbance was robustly

associated with poorer psychological and physical health. At study entry, higher subjective sleep disturbance significantly mediated the association between higher perceived subtle discrimination and higher depressive symptoms, worse global and cancer-specific quality of life, higher cancer-related anxiety, and more bothersome physical symptoms. Overall, the pattern of findings in Study 2 indicated that higher perceived discrimination was robustly associated with poor sleep, which may explain, in part, the significant relationships observed between higher perceived discrimination and poorer psychological and physical health-related outcomes in Study 1. Future research is recommended to develop health care provider- and patient-focused interventions to reduce lung cancer stigma and test whether such interventions promote health and well-being for this underserved and understudied population.

The dissertation of Timothy John Williamson is approved.

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Chapter 1: General Introduction

Chronic stressors often necessitate considerable psychological and physical adjustment. As conceptualized in stress and coping theory (Lazarus & Folkman, 1984), the ways in which people cope with stress influence health and well-being. Accordingly, extensive research has investigated risk and protective factors for favorable adjustment to chronic stressors, including life-threatening medical conditions such as cancer. However, this research has been conducted largely with adults with breast or prostate cancer, which are the most commonly diagnosed cancers in the U.S. and are widely known by the public (e.g., Linsell, Burgess, & Ramirez, 2008; Mainous & Hagen, 1994). Less is known about psychosocial risk and protective factors for health and well-being for adults with lung cancer, which is the nation's leading cause of cancer-related mortality for men and women, accounting for 25% of cancer-related deaths in 2018 (Siegel, Miller, & Jemal, 2018). Due to the decline in smoking prevalence (Islami, Torre, & Jeman, 2015), newly developed screening technology (National Lung Screening Trial Research Team et al., 2011), and advances in medical treatment (e.g., Garon et al., 2015), lung cancer mortality has declined by 38% for men and 12% for women over the past several decades (American Cancer Society, 2016), and an estimated 415,000 men and women in the U.S. are living with a lung cancer diagnosis (Howlander et al., 2016). As such, it is crucial to identify psychosocial factors that can promote health and quality of life in lung cancer patients, an understudied medical population.

Lung cancer can be a profoundly stressful experience. The majority of lung cancer patients are diagnosed with advanced stage disease that has metastasized to other parts of the body (Howlander et al., 2016; Siegel, Miller, & Jemal, 2018). Lung cancer patients report high levels of bothersome physical symptoms (Cooley, 2000), including distress from symptoms such

as nausea and weakness (Gift, Jablonski, Stommel, & Given, 2004). Additionally, lung cancer patients commonly report the co-occurrence of cough, breathlessness, and fatigue (Molassiotis, Lowe, Blackhall, & Lorigan, 2011). For a substantial proportion of lung cancer patients, these symptoms impair daily functioning and quality of life (Hung et al., 2011; Ostroff et al., 2011; Schag, Ganz, Wing, Sim, & Lee, 1994).

The experience of lung cancer also is associated with compromised psychological well-being. Patients report high levels of depressive symptoms (Hopwood & Stephens, 2000), anxiety (Aass, Fosså, Dahl, & Moe, 1997), and cancer-related distress (Tishelman, Petersson, Degner, & Sprangers, 2007). The prevalence of elevated depressive symptoms and anxiety is high in cancer patients compared with heathy populations (Kessler et al., 2013; Mitchell et al., 2011), and evidence suggests that patients with lung cancer, compared to other cancer types, may be particularly at risk to experience psychological morbidity (Brintzenhofe-Szoc et al., 2009; Zabora, Brintzenhofeszoc, Curbow, Hooker, & Piantadosi, 2001). In a study of more than 10,000 cancer patients, distress was highest among adults with lung cancer, compared to several other cancer types (e.g., breast, prostate); furthermore, 26% of lung cancer patients experienced clinical levels of anxiety and 18% of lung cancer patients experienced clinical levels of depression (Linden, Vodermaier, MacKenzie, & Greig, 2012). These statistics may underestimate rates of depression and anxiety, given that attrition in lung cancer research can arise from psychological burden of the disease (Uchitomi et al., 2003).

Demographic and medical characteristics are relevant in identifying cancer patients who are most likely to experience physical and psychological morbidity. Specifically, predictors of poor adjustment to cancer include female gender (Hopwood & Stephens, 2000; Linden et al., 2012; Vodermaier, Linden, MacKenzie, Greig, & Marshall, 2011), younger adult age (Avis et

al., 2012; Lo et al., 2010), unmarried status (Bradley, Rose, Lutgendorf, Costanzo, & Anderson, 2006; Stanton et al., 2015), socioeconomic disadvantage (Carlsen, Jensen, Jacobsen, Krasnik, & Johansen, 2005; Stanton et al., 2015), a greater number of metastases (Ciaramella & Poli, 2001), later stage disease (Hinz et al., 2010), and a greater number of comorbid diseases (Stanton et al., 2015). However, some studies in lung cancer patients have found no significant differences in adjustment by sex (Aass et al., 1997), age (Aass et al., 1997; Hopwood & Stephens, 2000; Linden et al., 2012), marital status (Lo et al., 2010), socioeconomic status (Lo et al., 2010), cancer stage (Kurtz, Kurtz, Stommel, Given, & Given, 2002), and number of comorbid diseases (Kurtz et al., 2002). These characteristics are generally stable and not particularly amenable to intervention. Additionally, these characteristics can be a proxy for more proximally related psychological variables (e.g., martial status may be a proxy for perceived support), which can be reliably measured and may relate more closely to health and well-being.

It is important to identify psychosocial factors that predict poor health and can be ameliorated through prevention and intervention approaches. Perceived stigma (i.e., the perception that one's character is devalued based on a distinguishing characteristic; Dovidio, Major, & Crocker, 2000) is a psychosocial risk factor that is especially important to study in this population, because lung cancer is stigmatized owing to its association with smoking, the perception of the disease as self-inflicted, and the grim expectations about the type of death to be experienced (for review, see Chambers et al., 2012). Perceived stigma is frequently reported by lung cancer patients (Chapple, Ziebland, & McPherson, 2010; Hamann et al., 2014) and is reliably related in cross-sectional studies to more depressive symptoms, poorer quality of life, and higher psychological distress among lung cancer patients (Cataldo, Jahan, & Pongquan,

2012; Chambers et al., 2012; Criswell, Owen, Thornton, & Stanton, 2016; Else-Quest, LoConte, Schiller, & Hyde, 2009; Gonzalez & Jacobsen, 2012).

Longitudinal research is needed to test whether lung cancer stigma predicts change in the proposed outcomes over time, which would inform theoretical models with regard to the temporality of stigma as a predictor of poor psychological and physical health outcomes. Also, testing psychosocial moderators of the stigma-health relationship may identify malleable factors that can be identified early to inform interventions to reduce subsequent health morbidity. Researchers have issued calls to incorporate stigma into broader investigations of adjustment to cancer (Chambers et al., 2012), to test whether lung cancer stigma relates to health outcomes across time (Criswell et al., 2016; Gonzalez & Jacobsen, 2012), and to examine indicators of stigma and its associated experiences (e.g., discrimination) simultaneously to better characterize their health consequences (Stuber, Meyer, & Link, 2008). Accordingly, the primary aim of Study 1 was to investigate longitudinally the role of internalized stigma (i.e., directing negative societal attitudes towards oneself; Stuber, Meyer, & Link, 2008) and perceived discrimination (i.e., subjective perceptions of unfair treatment; Taylor, Wright, & Porter, 1994) in predicting psychological and physical adjustment in lung cancer patients across 12 weeks.

In addition to identifying predictors of poor adjustment, research is needed to investigate the role of protective psychosocial factors that contribute to positive adjustment and buffer the potentially harmful effects of risk factors. To this end, several studies have demonstrated that more active, approach-oriented coping strategies predict positive psychological and physical health-related adjustment for cancer populations generally (e.g., Roesch et al., 2005; Stanton et al., 2000) and lung cancer patients specifically (Walker, Zona, & Fisher, 2006). Additionally, lower engagement in avoidant coping strategies is generally associated with better psychological

and physical health in cancer patients generally (e.g., Bauer et al., 2016; Bauer, Wiley, Weihs, & Stanton, 2017; Roesch et al., 2005) and lung cancer patients specifically (Faller, Bülzebruck, Drings, & Lang, 1999; Quinn, Fontana, & Reznikoff, 1987). Evidence is accumulating that self-compassion (i.e., directed compassion towards oneself in times of stress; Neff, 2003) predicts positive psychological functioning in the healthy adults (for meta-analyses, see MacBeth & Gumley, 2012; Zessin, Dickhäuser, & Garbade, 2015), and higher self-compassion was cross-sectionally associated with lower distress in a sample of lung cancer patients (Schellekens et al., 2017). Therefore, Study 1 also tested whether measures of approach-oriented and avoidant coping and self-compassion significantly attenuated the potentially harmful effects of stigma on health outcomes. Specifically, we examined whether relationships between stigma and discrimination and health outcomes were weaker (or statistically nonsignificant) for participants who reported high self-compassion, low avoidant coping, and high approach-oriented coping, as compared to participants who reported low self-compassion, high avoidant coping, and low approach-oriented coping.

Finally, identifying mechanisms through which psychosocial factors predict health outcomes can aid in developing maximally efficacious interventions and contribute to theoretical understanding of how psychosocial factors influence health and well-being. One pathway through which perceived stigma may relate to health outcomes is sleep behavior. Lung cancer patients evidence profound sleep disturbance (e.g., Le Guen et al., 2007), perhaps due persistent cough and pain (Molassiotis et al., 2011) or pre-sleep worry (Chen, Yu, & Yang, 2008). Sleep disturbance is a well-established predictor of depression (e.g., Baglioni et al., 2011; Cho et al., 2008; Ford & Kamerow, 1989) and is associated with poor quality of life (e.g., Strine & Chapman, 2005) in the general population. Additionally, sleep disturbance has been associated

with depressive symptoms (Du-Quiton et al., 2010) and impaired quality of life (Chen et al., 2008; Grutsch et al., 2011) among lung cancer patients.

Less is known on whether perceived stigma and discrimination predicts sleep disturbance, but emerging correlational evidence indicates a relationship between higher perceived stigma (Ong, Burrow, Fuller-Rowell, Ja, & Sue, 2013) and discrimination (Lewis et al., 2013; Slopen & Williams, 2014) and greater sleep difficulties. Additionally, research indicates that feelings of regret, self-blame, shame, and guilt in non-cancer populations predict poor sleep (Guan, Zhang, & Wang, 2008; Schmidt, Renaud, & Van der Linden 2011; Schmidt & Van der Linden, 2013; Wu, Zhang, & Deng, 2003). Given that the majority of lung cancer patients report such feelings (Hamann et al., 2014), it is likely that internalized lung cancer stigma is related to poor sleep. Accordingly, the primary aim of Study 2 was to test whether sleep disturbance mediated the relationship between perceived stigma and health outcomes.

These studies were designed to illuminate putative risk and protective factors for important health outcomes in lung cancer patients. Results may promote early identification of patients who are in need of psychosocial intervention and will point to factors that can be targeted for prevention and intervention. Additionally, these findings extend existing research on theories of stigma and health by investigating sleep as a mechanism through which perceived stigma predicts poor health outcomes.

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Chapter 2: Stigma as a predictor of health-related adjustment in lung cancer patients: The moderating role of coping processes and self-compassion (Study 1)

Abstract

Objective: Stigma and discrimination confer risk for poor mental and physical health. This study focused on adults with lung cancer, a population that frequently reports experiences of stigma as well as compromised psychological and physical health. The primary aim of this study was to investigate longitudinally the influences of lung cancer-related stigma and discrimination on health-related adjustment across 12 weeks. Additionally, the moderating role of specific coping strategies and self-compassion were tested.

Method: Adults on active oncologic treatment for lung cancer (N = 101, 52.4% male, mean [SD] age = 64.5 [11.6] years) completed measures of stigma, discrimination, and psychological and physical health at study entry and at 6- and 12-week follow-up. Multivariable linear regression models were used to investigate cross-sectional and longitudinal relationships of stigma and discrimination with psychological and physical health-related adjustment as well as psychological moderators (i.e., coping strategies, self-compassion) of these relationships.

Results: At study entry, higher internalized stigma and perceived subtle discrimination were associated significantly and uniquely with higher depressive symptoms, worse global quality of life, and higher cancer-related anxiety (all $p < .034$). Furthermore, higher internalized stigma (but not perceived discrimination) predicted significant declines in global quality of life and increases in depressive symptoms and cancer-related anxiety across time (all $p < .033$). Higher self-compassion and low avoidant coping (but not approach-oriented coping) significantly moderated relationships of internalized stigma and perceived discrimination with psychological outcomes at study entry (all $p < .032$). Specifically, higher internalized stigma and higher perceived

discrimination were related significantly to poorer psychological outcomes at study entry, but these relationships were not statistically significant for participants who reported high self-compassion and low avoidant coping. Planned analyses revealed that among participants who were married or living as married, higher perceived discrimination from the partner was associated significantly with all measures of health-related adjustment at study entry (all $p < .015$) and with significant declines in physical health across 6 weeks (all $p < .036$). ***Conclusions:*** Results indicated robust relationships of internalized stigma and perceived subtle discrimination with health-related adjustment, despite low overall levels of reported stigma and discrimination. Protective psychosocial processes attenuated relationships between stigma indicators and psychological health outcomes, and future research should test whether intervention approaches that harness these processes can mitigate the deleterious effects of lung cancer-related stigma on psychological health and well-being.

Stigma as a predictor of health-related adjustment in lung cancer patients: The moderating role of coping processes and self-compassion

Stigma is classically defined as a "mark" that designates an individual as socially devalued (Goffman, 1963). Over the past several decades, theories and definitions have evolved to capture the multifaceted social phenomenon of stigma. Dovidio and colleagues (2000) define stigma as a broad social process that involves "the recognition of a difference based on some distinguishing characteristic and a consequent devaluation of the person" (p. 3). Stigma is commonly conceptualized as a psychosocial stressor (e.g., Meyer, 2003) and has been posited as a fundamental cause of morbidity and mortality (Hatzenbuehler, Phelan, & Link, 2013; A. Nelson, 2002). Stigmatization results in intrapersonal, interpersonal, and structural processes (Chaudoir, Earnshaw, & Andel, 2013) that are theorized to confer risk for poor mental and physical health (Chaudoir et al., 2013; Lick, Durso, & Johnson, 2013; Meyer, 2003). The present study focuses on two such processes: internalized stigma, defined as directed negative societal attitudes towards oneself (Stuber, Meyer, & Link, 2008) and perceived discrimination, which is subjective perceptions of unfair treatment as reported by the target of stigma (Taylor, Wright, & Porter, 1994).

Across an array of populations, poor mental and physical health outcomes are reliably associated with internalized stigma (for meta-analyses, see Livingston & Boyd, 2010; Logie & Gadalla, 2009; Mak, Poon, Pun, & Cheung, 2007) and perceived discrimination (for meta-analyses, see (Pascoe & Smart Richman, 2009; Schmitt, Branscombe, Postmes, & Garcia, 2014). Studies on stigma and discrimination have been conducted largely within separate research traditions, however. Researchers have called for investigations of internalized stigma and perceived discrimination simultaneously to better understand the health consequences of stigma

(Phelan, Link, & Dovidio, 2008; Stuber, Meyer, & Link, 2008). Accordingly, this study investigated the contributions of internalized stigma and perceived discrimination to psychological outcomes and physical symptoms among adults living with lung cancer, a stigmatized chronic disease (Chambers et al., 2012).

The health consequences of stigma and discrimination are not ubiquitous. Rather, the relationship between stigma, discrimination, and health varies as a function of the ways individuals attempt to manage experiences of stigma (see Pascoe & Smart Richman, 2009). This observation is consistent with transactional models of stress and coping (Lazarus & Folkman, 1984). As such, it is useful to examine protective and harmful psychosocial factors that moderate the relationship of stigma and discrimination with health. Such an investigation will further understanding of whom and under what conditions stigma and discrimination are most harmful. Additionally, malleable protective psychosocial factors can be harnessed through intervention approaches to mitigate the deleterious effects of stigma and discrimination. In sum, the overarching aims of this study were to: 1) investigate whether internalized stigma and perceived discrimination predict psychological and physical adjustment in lung cancer patients and 2) test whether self-compassion (i.e., directing kindness towards oneself when confronting distress; Neff, 2003a; Neff, 2003b), approach-oriented coping strategies, or avoidant coping strategies moderate the relationship between internalized stigma and perceived discrimination on health-related adjustment.

Lung Cancer as a Stigmatized Chronic Disease

People with chronic health conditions are often characterized as targets of stigma (e.g., Van Brakel, 2006). The context of lung cancer, specifically, provides an opportunity to understand the impact of stigma and coping processes on important, clinically relevant health

outcomes. The majority (90%) of lung cancer diagnoses can be attributed to the controllable health behavior of cigarette smoking (Alberg, Ford, & Samet, 2007), and research demonstrates that stigma is more frequently reported by cancer patients who have engaged in behaviors they believe contributed to their cancer (for review, see Lebel & Devins, 2008).

Qualitative data suggest that lung cancer is stigmatized due to its association with smoking, the perception of the disease as self-inflicted, and the lethality of the disease (for review, see Chambers et al., 2012). Indeed, the general population (Sriram et al., 2015) and medical professionals (Hamann et al., 2013; Sriram et al., 2015) evidence negatively biased perceptions towards lung cancer patients, and the increased social unacceptability of smoking contributes to the stigmatization of people who smoke (Stuber, Galea, & Link, 2008). Recently, research has investigated whether this stigmatization has contributed to the burden of illness for lung cancer patients.

Lung Cancer and Internalized Stigma

Perceived stigma is commonly reported among lung cancer patients (Hamann et al., 2014), and stigma is experienced more by lung cancer patients than several other patient groups (Chambers et al., 2012). Research on stigma in lung cancer patients has focused primarily on the internalization of stigma, which occurs when stigmatized individuals direct the negative attitudes of society toward themselves (Stuber, Meyer, & Link, 2008). Consistent with theory (Hamann et al., 2014) and research (Chambers et al., 2012), internalized lung cancer stigma is indicated by feelings of guilt, blame, and shame. Indeed, the majority (60%) of lung cancer patients reported experiences of internalized lung cancer stigma in a qualitative study (Hamann et al., 2014), and many patients report feelings of self-blame, regret, and shame surrounding their diagnosis (Chapple, Ziebland, & McPherson, 2010; Criswell, Owen, Thornton, & Stanton, 2016; Tod,

Craven, & Allmark, 2008). Additionally, lung cancer patients are more likely to blame themselves and make personal causal attributions for their disease, compared with breast and prostate cancer patients (Else-Quest, LoConte, Schiller, & Hyde, 2009).

Lung cancer stigma may also present as hypervigilance or anticipation of negative treatment (i.e., anticipated stigma; Stuber, Meyer, & Link, 2008). It is posited that anticipated stigma results in limited or constrained disclosure of one's lung cancer status to others (Hamann et al., 2014; Hamann, Shen, Thomas, Lee & Ostroff, 2017). Qualitative studies suggest that lung cancer patients expect that they will experience blame and stigma from their medical team (Chapple et al., 2010) and their social networks (Tod et al., 2008). Additionally, lung cancer patients report avoidance or discomfort about sharing their lung cancer status with others (Hamann et al., 2017). These expectations and feelings may prevent patients from reporting symptoms to their medical team or result in psychological distress.

Whereas some studies suggest that internalized stigma is higher among lung cancer patients who smoked (Criswell et al., 2016), others have found that lung cancer patients reported similar levels of stigma regardless of smoking history (Cataldo, Slaughter, Jahan, & Hwang, 2011). However, measures of internalized stigma vary across studies (Chambers et al., 2012), which precludes direct comparison. It is possible that constructs such as guilt and regret are higher among ever smokers (see Criswell et al., 2016) because the psychological experience of guilt and regret are closely linked with experience of smoking. By contrast, measures that capture isolation and shame (see Cataldo et al., 2011) may reflect more common experiences of lung cancer patients regardless of smoking history.

Lung Cancer and Perceived Discrimination

Conceptualizations of perceived discrimination often have distinguished between overt and subtle forms (Dovidio & Gaertner, 2000; Hebl, Foster, Mannix, & Dovidio, 2002). Overt discrimination refers to blatant acts of prejudice (Jones, Peddie, Gilrane, King, & Gray, 2016), whereas subtle discrimination is operationalized as prejudicial actions that are "ambiguous in intent to harm, difficult to detect, low in intensity, and often unintentional but are nevertheless deleterious" (Jones et al., 2016, p. 1589). Both overt and subtle discrimination are theorized to predict poor health (Stuber, Meyer, & Link, 2008) and both are reliably associated with adverse psychological outcomes such as depressive symptoms, anxiety symptoms, high distress, and impaired well-being (for meta-analyses, see Jones et al., 2016; Pascoe & Smart Richman, 2009).

Subtle discrimination is more frequently experienced than overt discrimination (Utsey, Chae, Brown, & Kelly, 2002; Van Laer & Janssens, 2011; Yoo, Steger, & Lee, 2010) and is more difficult to detect (Hebl et al., 2002). For these reasons, researchers have posited that experiences of subtle discrimination may lead to internal rather than external attributions of the discriminatory behavior (Jones et al., 2016). Furthermore, meta-analytic findings indicate that the health impacts of subtle discrimination and overt discrimination are equally consequential for health (Jones et al., 2016).

In the context of lung cancer, perceived discrimination is understudied, despite it being conceptualized as a consequence of lung cancer-related stigmatization (Cataldo et al., 2011). Although qualitative data suggest that lung cancer patients report *fear* of overt discrimination such as being denied treatment (Chapple et al., 2010; Corner, Hopkinson, & Roffe, 2006; Tod et al., 2008), researchers have seldom assessed *perceptions* of overt discrimination. Furthermore, no study has assessed subtle discrimination in lung cancer patients, which may be particularly

important in light of its demonstrated high frequency and pervasiveness in other samples (Jones et al., 2016).

Studies using the Cataldo Lung Cancer Stigma Scale (Cataldo et al., 2011) assess whether patients perceive the public to discriminate against lung cancer patients generally (e.g., "People with lung cancer are treated like outcasts", p. 14) and anticipate future discrimination (e.g., "I worry about people discriminating against me", p.14). However, patients' perceived experiences of discrimination are not assessed with this measure. Therefore, research is needed in lung cancer patients to measure perceived experiences discrimination, which are known to robustly predict mental and physical health (e.g., Pascoe & Smart Richman, 2009).

One quantitative study measured a construct termed "medical stigma" that captures perceptions of unfair treatment (e.g., "Doctors have taken steps that have made my cancer worse than it would have been otherwise"; Criswell et al., 2016, p. 244). Lung cancer patients perceived very low levels of medical stigma, which did not vary by smoking history (Criswell et al., 2016). Thus, it is possible that *fear* of unfair treatment may be a common experience in lung cancer, whereas perceptions of actual unfair treatment are reported relatively infrequently (Criswell et al., 2016). Lung cancer patients may experience subtle forms of discrimination more frequently than overt discrimination, which would be consistent with studies on racial discrimination (Utsey et al., 2002; Yoo et al., 2010). Research is needed to characterize the experiences of subtle discrimination in lung cancer patients and to investigate whether subtle discrimination predicts health-related adjustment in this population.

Psychological and Physical Health Consequences of Internalized Stigma and Perceived Discrimination

Internalized stigma. Internalized stigma in lung cancer patients is consistently associated with poor psychological health outcomes, including high depressive symptoms, anxiety symptoms, and high psychological distress, as well as poor quality of life (Cataldo & Brodsky, 2013; Cataldo, Jahan, & Pongquan, 2012; Chambers et al., 2012, 2015; Criswell et al., 2016; Else-Quest et al., 2009; Gonzalez & Jacobsen, 2012). Moreover, internalized stigma is more strongly associated with distress in lung cancer patients, compared with breast or prostate cancer patients (Else-Quest et al., 2009). Associations between internalized stigma and psychological health are reliably observed across patients with and without a history of smoking (Brown Johnson, Brodsky, & Cataldo, 2014; Cataldo et al., 2011). One study demonstrated that the relationship between adverse psychological outcomes and regret, a specific component of internalized stigma, may be particularly strong among never smokers (Criswell et al., 2016). It is possible that regret among never smokers reflects a tendency to ruminate about several past actions in an attempt to make sense of the diagnosis, whereas former and current smokers endorse regret specifically about their smoking history.

Although researchers argue that internalized stigma contributes to psychological morbidity, the correlational nature of these studies precludes causal inference. Additionally, research has not assessed whether stigma predicts psychological adjustment to lung cancer over time. There have been calls for longitudinal investigations of stigma and psychological health (Criswell et al., 2016; Gonzalez & Jacobsen, 2012), which would allow for the assessment of temporal relationships between these variables.

Internalized stigma is also posited to predict poor physical health (Chaudoir et al., 2013). Overall, little research has examined the association between internalized stigma and physical health among lung cancer patients. One cross-sectional study demonstrated a relationship

between higher internalized stigma and greater physical symptom severity in lung cancer patients (Cataldo & Brodsky, 2013). In another study, higher regret was associated with more bothersome physical symptoms among patients who never smoked, but there was no relationship among lung cancer patients with a smoking history (Criswell et al., 2016).

Although research on internalized stigma and lung cancer-related physical health outcomes is limited, a wider body of research is available on internalized stigma and physical health in other medical patient samples. Findings from studies in HIV/AIDS patients demonstrate a reliable, moderate relationship between high internalized stigma and poor physical health (r = -.32; for meta-analysis, see Logie & Gadalla, 2009). Growing evidence from quantitative studies suggests that internalized stigma is also related to poor self-rated physical health in people with binge eating disorder (Pearl, White, & Grilo, 2014) and inflammatory bowel disease (Taft, Ballou, & Keefer, 2013). However, these studies are cross-sectional in design. As such, temporal relationships between health-related intrapersonal stigma and physical health outcomes are unknown.

Perceived discrimination. Perceived discrimination is also theorized to be harmful for psychological and physical health (Krieger, 2000; Lick et al., 2013). In a sample of 213 lung cancer patients, Criswell and colleagues (2016) showed that "medical stigma"—defined as perceptions of unfair treatment from the medical team—was associated with higher depressive symptoms, intrusive thoughts, and distress, as well as more bothersome physical symptoms. Never smokers evidenced a particularly strong relationship between "medical stigma" and adverse psychological outcomes, whereas both never smokers and current or former smokers evidenced a moderate relationship between "medical stigma" and physical symptom bother (Criswell et al., 2016).

No studies have assessed the role of subtle discrimination on health in lung cancer patients. Given how infrequently lung cancer patients report overt experiences of unfair treatment (Criswell et al., 2016), it may be useful to assess perceived subtle discrimination among lung cancer patients. Furthermore, a recent meta-analysis revealed that the strength of the relationships between subtle discrimination and psychological and physical health were just as substantial as the relationships between overt discrimination and health (Jones et al., 2016). Research is needed to understand how lung cancer-related discrimination relates to health outcomes over time, and there is a specific need to investigate subtle discrimination, which may be more frequently experienced by patients.

Protective Psychosocial Factors for Health-Related Adjustment

In addition to understanding how internalized stigma and perceived subtle discrimination relate to adverse psychological and physical health outcomes, it is important to investigate protective psychosocial factors that predict positive health-related adjustment and potentially buffer against the harmful effects of stigma. Several psychosocial factors have been demonstrated to predict positive adjustment to cancer (Stanton et al., 2005; Stanton, Danoff-Burg, et al., 2000; Yanez et al., 2009); a major goal of the proposed research was to examine whether protective psychosocial factors moderate the relationship between stigma and health.

Coping processes and self-compassion were selected as protective psychosocial factors in the present study because of their established relationships with the proposed outcomes, theoretical pertinence to lung cancer-related stigma, and ability to be harnessed through intervention approaches (e.g., Neff & Germer, 2013; Stanton et al., 2002). These protective factors were hypothesized to promote better outcomes in lung cancer patients in part by helping them manage their internalized stigma and perceptions of discrimination effectively.

Coping processes. Coping processes reflect voluntary or involuntary attempts to manage demands from a stressor that are perceived to exceed one's own resources (Lazarus & Folkman, 1984; Taylor & Stanton, 2007). The consequences of stigma are posited to be dependent, in part, on the responses and reactions of the stigmatized person (Dovidio et al., 2000). Thus, the ways in which lung cancer patients cope with their disease may influence the impact of stigma on health-related adjustment. For the purpose of this study, we investigate two domains of voluntary coping responses: 1) approach-oriented coping; and 2) avoidant coping.

Approach-oriented coping involves active efforts to manage the stressor or the stressor-related emotions, which includes processes such as active acceptance, problem solving, or processing and expressing one's emotions (Miller & Kaiser, 2001; Roth & Cohen, 1986; Stanton, Kirk, Cameron, & Danoff-Burg, 2000). Overall, approach-oriented coping strategies predict favorable psychological and physical health outcomes in patients with breast or prostate cancer (Hack & Degner, 2004; Roesch et al., 2005; Shapiro et al., 1997; Stanton, Danoff-Burg, et al., 2000). One correlational study demonstrated that approach-oriented coping is associated with fewer depressive symptoms among lung cancer patients (Faller, Bülzebruck, Drings, & Lang, 1999). Active coping strategies are posited to be important for the health and well-being for stigmatized populations (Miller & Kaiser, 2001), and the present study tested whether greater use of approach-oriented coping strategies mitigated the relationship of stigma and perceived discrimination with health-related adjustment for lung cancer patients.

Voluntary avoidant coping involves strategies to avoid thoughts and feelings associated with the stressor such as withdrawal, disengagement, or denial (Miller & Kaiser, 2001; Roth & Cohen, 1986). Overall, avoidance predicts poorer psychological and physical health in breast or prostate cancer patients (Bauer et al., 2016; Lepore & Helgeson, 1998; Manne, Ostroff, Winkel,

Grana, & Fox, 2005; Roesch et al., 2005; Stanton & Snider, 1993). In lung cancer patients, specifically, avoidant coping strategies are related to greater distress (Quinn, Fontana, & Reznikoff, 1987) and depressive symptoms (Faller et al., 1999).

Volitional avoidance may paradoxically prompt more intrusive thoughts about the stressor (e.g., Bauer, Wiley, Weihs, & Stanton, 2017; Smart & Wegner, 1999), which may lead to hypervigilance to threat about one's lung cancer status and sensitivity to the effects of stigma. In that low levels of risk factors can be conceptualized as protective (e.g., Neff, 2016), we posited that low levels of avoidant coping would attenuate the relationship between internalized stigma, perceived subtle stigma, and health-related outcomes.

Self-compassion. As defined by Neff (2003a, 2003b), self-compassion is the action of directing compassion towards oneself when confronting distress or painful circumstances. Self-compassion is linked with adaptive psychological functioning (for meta-analyses, see MacBeth & Gumley, 2012; Zessin, Dickhäuser, & Garbade, 2015). In the context of cancer, self-compassion is related to lower psychological distress in breast (Przezdziecki et al., 2013) and lung cancer patients (Schellekens et al., 2017). These studies were cross-sectional, which prevents causal inference.

Self-compassion may be particularly relevant for ameliorating the health impacts of stigma, because self-compassion interventions have been used to target shame, which is an indicator of internalized stigma (Hamann et al., 2014). Experimental findings demonstrate that self-compassion interventions reduce feelings of shame (Albertson, Neff, & Dill-Shackleford, 2015), body image-specific shame (Breines, Toole, Tu, & Chen, 2013), and depressive symptoms in shame-prone individuals (Johnson & O'Brien, 2013). In the present study, we

tested whether self-compassion moderates the relationships between internalized stigma and perceived discrimination on health-related adjustment in lung cancer patients.

Aims of the Proposed Study

In the present study, internalized stigma, perceived discrimination, cancer-related coping strategies, self-compassion, and psychological and physical adjustment were assessed in a sample of 101 lung cancer patients at study entry and at 6- and 12-week follow-up. Elucidating predictors of psychological and physical health outcomes will aid in the development of prevention and intervention efforts geared towards improving quality of life in adults as they adjust to the diagnosis and treatment of lung cancer.

Aim 1. The first aim of the present study was to investigate the relationships of lung cancer-specific stigma and discrimination with health-related adjustment.

Hypothesis 1. Higher lung cancer-specific internalized stigma and higher perceived subtle discrimination will be associated at study entry with poorer psychological (i.e., fewer depressive symptoms, fewer anxiety symptoms, lower global quality of life) and physical health-related outcomes (i.e., lower cancer-specific quality of life, more bothersome physical symptoms).

Hypothesis 2. Higher internalized stigma and perceived subtle discrimination at study entry will predict declining psychological and physical health outcomes across 12 weeks.

Aim 2. The second aim of the proposed research was to test coping processes and self-compassion as moderators of the relationships between lung cancer-related stigma and psychological and physical health outcomes.

Hypothesis 3. Greater use of cancer-related approach-oriented coping, higher levels of self-compassion, and less avoidance-oriented coping will attenuate the relationships between

internalized stigma, perceived subtle discrimination, and poorer psychological and physical health outcomes.

Method

Participants

Men and women diagnosed with lung cancer were recruited to participate in the study through a university-affiliated lung cancer clinic. Patients were eligible if they were: 1) diagnosed with lung cancer (any type, any diagnosis duration); 2) receiving active oncologic treatment; 3) at least 18 years of age; and 4) comfortable reading and responding to questions in English. Participants undergoing any oncologic treatment for lung cancer were allowed to participate. Participants were ineligible if cognitive impairment was apparent. Consecutive patients were recruited to reduce potential bias. All participants provided written informed consent.

Power analysis. Power analysis revealed that a sample size of 120 participants would provide 80% power to detect a significant effect at $p < .05$ with a moderate effect size ($R^2 = .15$, Cohen, 1988). This effect size estimate was selected based on a previous correlative study in lung cancer patients recruited from the same clinic (Kurita, Garon, Stanton, & Meyerowitz, 2013). Current analyses include participants who completed at least one survey assessment (N = 101) and for whom medical chart data were available, which provided 88% power to detect a statistically significant bivariate correlation with a moderate effect size at $p < .05$ and 72% power to detect a significant effect at $p < .05$ in a multivariable regression with 10 predictors.

Procedure

Consecutive patients at the UCLA Hematology/Oncology clinic were screened and approached for recruitment by study staff, within scheduling constraints. At study entry as well

as 6 weeks and 12 weeks later, eligible participants who provided written informed consent to enroll in the study were asked to complete questionnaires. Every effort was made to coincide questionnaire administration with a regularly scheduled medical appointments to prevent burden. Participants were allowed to complete the questionnaires via a paper-and-pencil survey or online link, and participants were allowed to complete the survey in the clinic or at home. All participants were provided with a pre-addressed envelope to return their completed questionnaires or with a digital link to complete the questionnaires via the Internet (note: there were no significant differences in study outcomes by location or method of survey completion). All procedures were approved by the Institutional Review Board at the University of California, Los Angeles.

Measures

Medical and demographic information. Relevant medical data (e.g., cancer type and stage, diagnosis duration, medical treatments) and demographic information (e.g., age, sex, race/ethnicity, education, marital/partner status) were assessed through medical chart review and patient report, with informed consent.

Internalized stigma. Internalized stigma was measured using an adapted version of the Cancer Responsibility and Regret Scale (CRRS), which reliably characterized regret and personal responsibility in a sample of more than 200 lung cancer patients (Criswell et al., 2016). Specifically, we used the four items from the regret subscale (e.g., "When it comes to my cancer, I have nothing to be ashamed of [reverse scored]") in addition to four new items adapted from HIV-related stigma scales (Berger, Ferrans, & Lashley, 2001; Kalichman et al., 2009), capturing feelings of shame, guilt, and self-blame (e.g., "I feel guilty that I have lung cancer"). The new items were agreed upon for inclusion via consensus of two members of the study team (one of

which is an author of the CRRS). A total score was used for analysis by computing a mean of the eight items. The Cronbach alpha reliability coefficient was adequate ($\alpha = .76$).

Perceived subtle discrimination. For the purpose of the present study, subtle discrimination was conceptualized from Hebl and colleagues' (2002) definition: "discrimination that is more subtle [and] involves the nonverbal, paraverbal, and even some of the verbal behaviors that occur in social interactions" (p. 816). The present study used a 50-item author-constructed measure to assess perceived experiences of discrimination that occur in social interactions and are attributed to one's lung cancer status (e.g., "Because of your lung cancer, how often do you experience any situations in which your friends avoid making eye contact with you?"). Participants responded to ten items that convey social situations in five social contexts: friends, partner (if applicable), family (other than partner), medical team members, acquaintances/co-workers. Eight items were generated using concepts described in one measure of HIV-stigma (Berger et al., 2001) and two measures of racial subtle discrimination (Nadal, 2011; Torres-Harding, Andrade, & Romero Diaz, 2012). An additional two items were developed by three members of the study team and were agreed upon unanimously for inclusion. Qualitative data suggest that lung cancer stigma is experienced across social contexts (Hamann et al., 2014), and the aforementioned five social contexts were selected to capture the range of social contexts through which patients may differentially experience subtle discrimination. A mean score averaging across all social domains was used ($\alpha = .95$).

Avoidant coping. Avoidant coping strategies were assessed at study entry using relevant subscales from the COPE (Carver, Scheier, & Weintraub, 1989), a scale used to assess the ways in which individuals respond to stressful situations. Participants responded to items in reference to their experience with lung cancer. The 40 items are measured on a 1-4 point Likert scale, with

higher scores indicating a greater tendency to use the specific coping strategy. This scale has previously been used to assess coping strategies in lung cancer patients (e.g., Thornton et al., 2012). The avoidance-oriented coping subscale consists of 12 items indicating denial and mental and behavioral disengagement related to cancer (e.g., I refuse to believe that it has happened). A mean composite score across these subscales was computed ($\alpha = .69$).

Approach-oriented coping. Approach-oriented coping was also assessed with 28 items from the COPE (Carver et al., 1989) as well as the Emotional Approach Coping scales (Stanton, Kirk, et al., 2000). The approach-oriented subscales from the COPE include problem-focused coping, acceptance, social support, and positive reinterpretation, and the Emotional Approach Coping subscales include emotional processing and emotional expression. Sample items include "I feel free to express my emotions" and "I accept the reality of the fact that it happened". The aforementioned subscales were included in the computation of a mean composite score ($\alpha = .92$).

Self-compassion. Self-compassion was measured at study entry using the 12-item version of the Self-Compassion Scale (Neff, 2003a; Raes, Pommier, Neff, & Van Gucht, 2011), the most widely used scale to assess self-compassion. The scale has demonstrated excellent reliability and validity (Neff, 2003a). Self-compassion is posited to predict adjustment for people confronting medical stressors (Terry & Leary, 2011). It has been used previously in health-related research, including cancer patient samples (e.g., Birnie, Speca, & Carlson, 2010). Factor analytic results demonstrate that the total score can be used as an overall measure of self-compassion or that the six subscales (i.e., self-kindness, self-judgment, common humanity, isolation, mindfulness, over-identification) can be analyzed as separate constructs (Neff, Whitaker, & Karl, 2017). A total summed score was used ($\alpha > .73$).

Dependent variables. Outcomes were assessed at study entry, 6-week, and 12-week follow up. Dependent variables included global and cancer-related measures of adjustment across psychological and physical health domains.

Depressive symptoms. The 20-item Center for Epidemiologic Studies-Depression scale (Radloff, 1977) was used to measure depressive symptoms. The scale has well-established internal consistency reliability ranging from .84 to .90 (Radloff, 1977). It has been used in studies assessing depressive symptoms in cancer patients with good reliability and validity (Hann, Winter, & Jacobsen, 1999; Stanton et al., 2005). A total score of 16 or above suggests clinically significant levels of depression (e.g., Andresen, Malmgren, Carter, & Patrick, 1994). Current internal consistency reliability was adequate (all $\alpha > .84$).

Global quality of life. The 27-item Functional Assessment of Cancer Therapy-General scale was used to measure multidimensional quality of life, including physical, emotional, social, and functional well-being (Cella, Tulsky, & Gray, 1993). It has been used in research to measure cancer-specific quality of life in lung patients (Hollen & Gralla, 1996; Kurita et al., 2013). The total score as well as each of the component subscales can be analyzed reliably with Cronbach's alphas ranging from .69 to .89 (Cella et al., 1993). For the present study, a total score was used for analyses (all $\alpha > .93$).

Cancer-specific quality of life. The 9-item Functional Assessment of Cancer Therapy-Lung Cancer subscale was used to measure symptoms and concerns specific to the lung cancer experience (Cella et al., 1995). It has established reliability with a coefficient alpha of .68 (Cella et al., 1995), and it has been used widely to measure lung cancer-specific concerns in patients (e.g., Hollen & Gralla, 1996; Kurita et al., 2013). Current internal consistency reliability was adequate (all $\alpha > .69$).

Cancer-related anxiety. Cancer-related anxiety was assessed using the 20-item Post-Traumatic Stress Disorder Checklist for the Diagnostic and Statistical Manual-5 (Blevins, Weathers, Davis, Witte, & Domino, 2015), which demonstrates excellent reliability and validity. Symptoms of post-traumatic stress disorder have been measured reliably in cancer patients (DuHamel et al., 2004). Participants responded to each item in reference to their experience with lung cancer. Participants responded on a Likert scale from 0 (not at all) to 4 (extremely) about how bothered they were by a series of problems (e.g., "In the past month, how much were you bothered by repeated, disturbing dreams of the lung cancer experience"). A total score and the score on each of the component subscales (i.e., re-experiencing, avoidance, negative cognition/mood, arousal) can be analyzed reliably. The total score was used (all $\alpha > .90$).

Physical symptom bother. The 12-item short form of the Memorial Symptom Assessment-Physical Symptom subscale, which measures common physical symptoms reported by patients (Portenoy et al., 1994), was used to determine how frequent and bothersome physical symptoms are reported by participants. Participants respond on a 5-point Likert scale, with higher scores indicating more symptom bother. This scale has good reliability and validity when used in cancer patient samples generally (Chang, Hwang, Feuerman, Kasimis, & Thaler, 2000) and lung cancer specifically (Sanders, Bantum, Owen, Thornton, & Stanton, 2010). A mean score of physical symptom bother was used (all $\alpha > .81$).

Analytic Plan

Descriptive statistics were computed for all continuous and categorical predictors and outcomes. Pearson's correlations were computed to assess the relationships between the predictors and the dependent variables to characterize the zero-order relationships. The evidence that patient or medical characteristics are related to the proposed outcomes in lung cancer

patients is inconsistent (see Aass, Fosså, Dahl, & Moe, 1997; Hopwood & Stephens, 2000; Kurtz, Kurtz, Stommel, Given, & Given, 2002; Linden, Vodermaier, MacKenzie, & Greig, 2012; Lo et al., 2010). As such, only age, sex, race/ethnicity, and smoking status were included as covariates a priori. Additionally, any patient or medical characteristic related to the outcome at $p < .05$ was added as a covariate, which is consistent with published methodology (e.g., Rini et al., 2014). Participant survey non-completion was assessed via independent samples t-tests to investigate whether attrition was associated with patient, medical, or psychosocial variables.

Hypothesis 1. Higher internalized stigma and perceived subtle discrimination will be associated at study entry with poorer psychological and physical health outcomes. Multivariable regression analyses of cross-sectional data at study entry were conducted to investigate internalized stigma and perceived subtle discrimination simultaneously as correlates of the proposed dependent variables, controlling for pertinent patient and medical characteristics. The outcome variables (depressive symptoms, global quality of life, cancer-specific quality of life, cancer-related anxiety, physical symptom burden) at study entry were each entered as the dependent variable in separate analyses.

Hypothesis 2. Higher internalized stigma and perceived subtle discrimination at study entry will predict declining psychological and physical health outcomes across 12 weeks. To test whether internalized stigma and perceived subtle discrimination predicted declining adjustment across psychological and physical health outcomes over 12 weeks, multivariable regression analyses were conducted. Internalized stigma and perceived subtle discrimination were entered simultaneously as predictors. To evaluate change over time in the outcome, the value of the dependent variable at study entry was entered as a covariate and the 6-week and 12-week follow-up values, respectively, were entered as dependent variables in separate analyses.

Hypothesis 3. Greater use of cancer-related approach-oriented coping, higher levels of self-compassion, and less avoidance-oriented coping will attenuate the relationships between internalized stigma, perceived subtle discrimination, and adverse psychological and physical health outcomes. The analytic approach outlined above was used to test whether protective psychosocial processes (i.e., high approach-oriented coping, low avoidance-oriented coping, high self-compassion) attenuated statistically significant relationships between stigma measures and the dependent variables. Each of the three protective psychosocial variables were entered into separate regression analyses along with the two-way interaction terms between the psychosocial factor and each stigma measure. Significant interactions were probed following established procedures for evaluating simple effects (Aiken & West, 1991; Holmbeck, 2002). Significant interactions between psychosocial moderators and stigma measures would provide support for the hypothesis that protective psychosocial processes buffer the deleterious effects of stigma on health-related adjustment.

Multivariable regression models were conducted using the SEM command in STATA v13 (Stata Corp., LLC) and estimated with full information maximum likelihood to address missing data (Enders & Bandalos, 2001). Two-tailed significance tests were used for all analyses, and $p < .05$ was considered statistically significant. Multilevel modelling was considered as an alternative analytic approach but was not selected because of the advantage of using multivariable regression models to evaluate covariates as predictors of change in the outcomes over time without including interaction terms between covariates and time (which would result in fewer degrees of freedom and reduced statistical power). Additionally, we did not want to constrain time with a singular slope across 12 weeks, given that quality of life can fluctuate during active treatment for lung cancer (Eton et al., 2003; Lo et al., 2010), and a

multilevel modelling approach with time as a categorical variable would have resulted in additional tests of statistical significance and an increased chance of Type I error.

Results

Sample Characteristics

Of 211 patients screened, 25 were ineligible, 40 declined to participate, and 20 passively refused (e.g., indicated interest in being re-approached but attempts to do so were unsuccessful). Of 186 eligible patients, 126 (68%) provided informed consent and the 101 (54%) participants (53 men, 48 women) who completed the first survey were included in subsequent analyses. Of the 101 participants, 80 (79%) and 69 (68%) participants completed the 6- and 12-week follow-up assessments, respectively. There was no evidence of differential participant attrition by sociodemographic, medical, or psychosocial characteristics. Specifically, participants who completed all assessments did not differ significantly from participants who completed one or two assessments on any variable included in subsequent analyses.

As shown in Table 1, on average, participants were 64.5 years old, and had 15.7 years of education. The majority was married/living as married, non-Hispanic White, had stage IV disease, and were currently participating in an oncologic clinical trial. The sample was comprised of 90 participants who were diagnosed with non-small cell lung cancer, eight with small cell lung cancer, and three with mesothelioma. Eight participants currently smoked, 56 formerly smoked, and 37 never smoked. Forty-nine participants were receiving immunotherapy, 24 were receiving chemotherapy, 8 were receiving targeted therapy, and 20 were receiving treatment that combined two or more of these therapeutic agents (with n = 19 out of 20 including at least one chemotherapy agent). Too few participants received targeted therapy to analyze as a separate group. As such, participants who were receiving immunotherapy or targeted therapy

were combined into one group in subsequent analyses. Immunotherapy and targeted treatment groups did not differ significantly on any variable included in analyses.

Descriptive Statistics and Zero-Order Correlations

Independent variables. Overall levels of internalized stigma (M = 2.42, SD = 1.17; possible range 1-7) and perceived subtle discrimination (M = 0.17, SD = 0.28; possible range = 0-4) were low. On average, patients reported slight disagreement with stigma items, although scores spanned the range of the scales with some patients endorsing moderate or strong agreement with stigma items. Overall, 50.5% (n = 50 of 99) of participants did not report any perceived experiences of subtle discrimination, and patients who did report perceived subtle discrimination most often indicated that it occurred rarely. Internalized stigma and perceived subtle discrimination were correlated significantly (r = .29, p = .003), and did not interact significantly to predict any of the study outcomes. As such, they were entered as simultaneous predictors in all subsequent multivariable regression models.

Dependent variables. Depressive symptoms and cancer-related anxiety were elevated in the current sample, in that 31.7% (n = 32 out of 99) and 28.7% (n = 29 out of 98) of participants reported symptoms suggestive of clinical depression and anxiety, respectively. On average, global quality of life (M = 78.21, SD = 16.39) was similar to adults with cancer and slightly lower than adults without cancer (Brucker, Yost, Cashy, Webster, & Cella, 2005). Notably, however, there was a meaningful difference (i.e., > 2 points; Brucker et al., 2005) in global quality of life between 46.5% (n = 46 out of 99) of participants in the current sample and the general adult population norms (Brucker et al., 2005). Lung cancer symptom scores (M = 19.90, SD = 5.32) were similar in the current sample to other samples of lung cancer patients (Cella et al., 1995; Langer et al., 2008). On average, physical symptom bother (M = 0.76, SD = .71) was

low, although there was considerable variability with average scores ranging from “no bother” to “quite a bit”.

Psychosocial moderators. Approach-oriented coping (M = 2.88, SD = 0.57) was endorsed to a greater degree than avoidant coping (M = 1.74, SD = 0.39). On average, scores of approach-oriented and avoidant coping were similar to those reported in studies with lung (Thornton et al., 2012) or breast cancer patients (Bauer et al., 2016). Overall, self-compassion scores (M = 44.71, SD = 8.50) indicated that participants were self-compassionate “fairly often”, but there was a wide range of individual responses ranging from “almost never” to “almost always”.

Zero-order correlations. At study entry, higher internalized stigma was associated significantly with higher depressive symptoms (r = .27, p = .007), worse global quality of life (r = -.28, p = .005), worse lung-cancer specific quality of life (r = -.23, p = .022), and more cancer-related anxiety (r = .27, p = .007), but was not significantly associated with physical symptom bother (r = .10, p = .306). Higher perceived subtle discrimination was related to higher depressive symptoms (r = .29, p = .003), worse global quality of life (r = -.43, p < .001), more cancer-related anxiety (r = .44, p < .001), and higher physical symptom bother (r = .26, p = .011), but was not significantly associated with lung-cancer specific quality of life (r = -.17, p = .100). All dependent variables were intercorrelated significantly ($|r|$ = .45-.80, all p < .001) (Table 2).

Approach-oriented and avoidant coping were not associated significantly (r = .068, p = .499). Self-compassion was correlated significantly with higher approach-oriented coping (r = .28, p = .005) and lower avoidant coping (r = -.26, p = .010). Higher avoidant coping and lower self-compassion were associated significantly with higher internalized stigma (r = .31,

p = .002), and higher avoidant coping was also related to higher perceived subtle discrimination (r = .36, p < .001). All other relationships between moderator and independent variables were not statistically significant. At study entry, higher self-compassion and lower avoidant coping, respectively, were associated significantly with lower depressive symptoms (|r|*'s* = .36-.38, all p < .001), better global quality of life (|r|*'s* = .34-.42, all p < .002), better lung-cancer specific quality of life (|r|*'s* = .21-.38, all p < .041), less cancer-related anxiety (|r|*'s* = .27-.38, all p < .008), and less physical symptom bother (|r|*'s* = .27-.30, all p < .008). Higher approach-oriented coping was associated significantly with better global quality of life (r = .28, p = .004) but was not correlated significantly to any other outcome variable.

Health Outcomes Regressed on Internalized Stigma and Perceived Subtle Discrimination

Covariates. To evaluate potential covariates for subsequent multivariable linear regression relationships, zero-order relationships were tested between age, sex (male, female), race/ethnicity (non-Hispanic white, other race/ethnicity), years of education, marital status (not married/living as married, married/living as married), yearly family income (below $100,000, above $100,000), smoking status (never smoked, currently/formerly smoked), months since lung cancer diagnosis, histology (non-small cell lung cancer, other histology), cancer stage (stage IV, stages I-III), current oncologic treatment (immunotherapy or targeted therapy, chemotherapy, combination therapy), line of current therapy (first, second, third, fourth or fifth), number of days since beginning current treatment, current participation in an oncologic clinical trial (no, yes), past receipt of chemotherapy (no, yes), and history of lung cancer-related surgery (e.g., lobectomy; no, yes) and all study outcomes.

At study entry, younger age was associated significantly with worse global quality of life (r = .22, p = .027). Having stage IV disease was associated significantly with worse cancer-

specific quality of life ($t(95) = 2.47$, $p = .015$). Lower yearly family income was related significantly to higher cancer-related anxiety ($t(93) = 2.67$, $p = .009$), and women reported higher physical symptom bother ($t(99) = -2.74$, $p = .007$). All other relationships between potential covariates and dependent variables were not statistically significant. As such, cancer stage and yearly family income were entered along with a priori covariates (i.e., age, sex, race/ethnicity, smoking status) in all subsequent analyses. Covariates did not interact significantly with internalized stigma or perceived subtle discrimination to predict any dependent variable.

Study entry. Relationships between internalized stigma, perceived subtle discrimination, depressive symptoms, global quality of life, cancer-specific quality of life, cancer-related anxiety, and physical symptom bother were tested at study entry, controlling for age, sex, race/ethnicity, smoking status, income, and cancer stage. All overall models were statistically significant (model $R^2 = .15$-$.30$, all $F(8, 93) > 2.05$, all $p < .05$). Higher internalized stigma and higher perceived subtle discrimination were associated significantly and uniquely with worse global quality of life (Table 3) and higher depressive symptoms (Table 4), accounting for 12% of the variance in global quality of life and 9% of the variance in depressive symptoms. Higher perceived discrimination (but not internalized stigma) was associated significantly with higher cancer-related anxiety (Table 5). Collectively, perceived discrimination and internalized stigma explained 8% of the variance in cancer-specific anxiety. Higher internalized stigma and perceived subtle discrimination were not uniquely associated significantly with study entry cancer-specific quality of life or physical symptom bother (Tables 6 and 7). Regarding covariates, women reported significantly higher cancer-related anxiety and physical symptom bother than men (Tables 5 and 7). Having stage IV disease was associated significantly with worse cancer-specific quality of life (Table 6).

Changes in health-related outcomes across 6 weeks. Internalized stigma and perceived subtle discrimination were tested as predictors of 6-week outcomes, controlling for covariates. To assess change, the study entry value of the dependent variable was entered as a covariate. All overall models were statistically significant (model R^2 = .31-.59, all $F(9, 92) > 4.59$, all $p < .001$). For each dependent variable, the study entry value significantly predicted the 6-week score, accounting for 19% to 32% of the variance. Higher internalized stigma significantly predicted declining global quality of life (Table 8) and increasing cancer-related anxiety (Table 9). Internalized stigma and perceived subtle discrimination collectively explained 2% of the variance in global quality of life and 8% of the variance in cancer-related anxiety across 6 weeks. Internalized stigma was not related significantly to 6-week changes in depressive symptoms (Table 10), cancer-specific quality of life (Table 11), or physical symptom bother (Table 12). Perceived subtle discrimination was not uniquely associated significantly with changes in any outcome across 6 weeks. Regarding covariates, non-Hispanic white race/ethnicity was associated significantly with declining global quality of life (Table 8).

Changes in health-related outcomes across 12 weeks. Internalized stigma and perceived subtle discrimination were tested as predictors of 12-week outcomes, controlling for covariates. To assess change, the study entry value of the dependent variable was entered as a covariate. All overall models were statistically significant (model R^2 = .39-.77, all $F(9, 92) > 6.54$, all $p < .001$). For each dependent variable, the study entry value significantly predicted the 12-week score, accounting for 14% to 29% of the variance. Higher internalized stigma significantly predicted decreases in global quality of life (Table 13) as well as increases in depressive symptoms (Table 14) and cancer-related anxiety (Table 15) across 12 weeks. Collectively, internalized stigma and perceived subtle discrimination explained 4% of the

variance in global quality of life, 7% of the variance in depressive symptoms, and 8% of the variance in cancer-related anxiety. Internalized stigma was not associated significantly with 12-week changes in cancer-specific quality of life (Table 16) or physical symptom bother (Table 17). Perceived subtle discrimination was not associated significantly with 12-week changes in any outcome. Regarding covariates, women evidenced significant increases in depressive symptoms (Table 14), and older age was associated significantly with increasing cancer-related anxiety (Table 15). Having higher yearly family income was associated significantly with increasing cancer-specific quality of life (Table 16).

In sum, there were significant associations between stigma indicators and health outcomes in eight of 15 tested models, controlling for age, sex, race/ethnicity, smoking status, income, and cancer stage.

Psychosocial Moderators of Internalized Stigma and Perceived Subtle Discrimination with Health-Related Adjustment

Interactions between protective psychosocial processes (i.e., high approach-oriented coping, low avoidance-oriented coping, high self-compassion), internalized stigma, and perceived subtle discrimination were tested to examine whether these processes attenuated relationships between stigma measures and the dependent variables, controlling for covariates. Significant interaction terms were probed by testing the relationship between the stigma measure and the dependent variable at the mean as well as at one standard deviation above and below the mean of the psychosocial moderator (Aiken & West, 1991; Holmbeck, 2002).

At study entry, higher self-compassion significantly attenuated the relationship between internalized stigma and depressive symptoms (b= 0.11, p = .031, 95% CI [0.39, -0.02]) as well as the relationship between perceived subtle discrimination and cancer-related anxiety (b = -0.86,

p = .032, 95% CI [-1.65, -0.76]). Higher internalized stigma was associated significantly with higher depressive symptoms at one standard deviation below the mean of self-compassion (*b* = 3.02, *p* = .010, 95% CI [0.75, 5.30]), but there was no significant relationship between internalized stigma and depressive symptoms at the mean (*b* = 1.22, *p* = .165, 95% CI [-0.51, 2.95]) or at one standard deviation above the mean of self-compassion (*b* = -0.59, *p* = .639, 95% CI [-3.06, 1.89]). Higher perceived subtle discrimination was associated significantly with higher cancer-related anxiety at the mean (*b* = 11.36, *p* = .002, 95% CI [4.50, 18.84]) and at one standard deviation below the mean of self-compassion (*b* = 3.02, *p* = .001, 95% CI [8.23, 29.80]), but there was no significant relationship between perceived subtle discrimination and cancer-related anxiety at one standard deviation above the mean of self-compassion (*b* = 4.33, *p* = .327, 95% CI [-4.41, 13.06]).

These findings demonstrate that there is a significant relationship between internalized stigma and depressive symptoms for participants who report low self-compassion but not for those with average or high levels of self-compassion. Additionally, there is a significant relationship between perceived discrimination and cancer-related anxiety for participants who report average or below average levels of self-compassion but not for those who report higher than average levels of self-compassion. Thus, self-compassion buffered the relationship of internalized stigma and discrimination with poorer outcomes.

Additionally, low avoidant coping attenuated the relationship between perceived subtle discrimination and cancer-related anxiety (*b*= 23.69, *p* = .003, 95% CI [8.00, 29.37]). Higher perceived subtle discrimination was associated significantly with higher cancer-related anxiety at one standard deviation above the mean of avoidant coping (*b* = 2.13, *p* = .049, 95% CI [0.01, 4.25]), but there was no significant relationship between perceived subtle discrimination and

cancer-related anxiety at the mean (b = 0.51, p = .586, 95% CI [-1.35, 2.38]) or one standard deviation below the mean of avoidant coping (b = -1.10, p = .383, 95% CI [-3.60, 1.40]). These findings demonstrate that there is a significant relationship between perceived discrimination and cancer-related anxiety for participants who report high levels of avoidant coping but not for those who report average or below average levels of avoidant coping.

There were no other significant interactions between protective psychosocial processes with internalized stigma and perceived subtle discrimination on health outcomes at study entry or across time. In sum, there was evidence of significant moderation in three of 27 tested models.

Exploratory Analyses

In planned analyses, relationships between internalized stigma and perceived subtle discrimination from each of the five social sources (friends, family, medical team, acquaintances/co-workers, and partner) were examined as in separate multivariable regression models as predictors of depressive symptoms, global quality of life, cancer-specific quality of life, cancer-related anxiety, and physical symptom bother at study entry and across time, controlling for age, sex, race/ethnicity, smoking status, income, and cancer stage. Only participants who indicated being married or living as married (n = 66 out of 101) were included in analyses that examined perceived subtle discrimination from a partner. All other participants did not answer the items about perceived discrimination from a partner.

Controlling for internalized stigma and covariates, higher perceived subtle discrimination from friends (b = -18.06, p < .001, 95% CI [-28.01, -8.03]), acquaintances/co-workers (b = -12.71, p = .002, 95% CI [-20.65, -4.77]), and family members (b = -9.06, p = .038, 95% CI [-17.64, -0.48]) were each associated significantly with worse global quality of life at study entry. Additionally, higher perceived subtle discrimination from friends (b = 13.22, p < .001,

95% CI [7.91, 18.54]), acquaintances/co-workers (b = 4.89, p = .043, 95% CI [0.16, 9.61]), and medical team members (b = 10.56, p < .001, 95% CI [4.75, 16.36]) were associated significantly with higher cancer-related anxiety at study entry. Higher perceived subtle discrimination from friends was also associated with higher depressive symptoms at study entry (b = 6.33, p = .031, 95% CI [0.58, 12.09]). Finally, higher perceived subtle discrimination from medical team members significantly predicted declining cancer-specific quality of life across 6 weeks (b = -3.98, p = .014, 95% CI [-7.15, -0.81]). There were no other significant relationships between perceived subtle discrimination from friends, family, medical team members, or acquaintances/co-workers and health outcomes at study entry or across time. There were significant associations between perceived subtle discrimination from particular social sources and health outcomes in eight of 60 tested models.

Among the subset of participants who were married or living as married, higher perceived subtle discrimination from one's partner was associated significantly with higher depressive symptoms (b = 14.54, p = .012, 95% CI [1.20, 5.89]), worse global quality of life (b = -32.48, p < .001, 95% CI [-50.51, -14.45]), poorer cancer-specific quality of life (b = -8.42, p = .002, 95% CI [-13.68, -3.17]), higher cancer-related anxiety (b = 13.20, p = .004, 95% CI [4.29, 22.11]), and higher physical symptom bother (b = 0.87, p = .014, 95% CI [0.18, 1.56]). Additionally, higher perceived subtle discrimination from one's partner significantly predicted declining cancer-specific quality of life (b = -6.16, p = .035, 95% CI [-11.88, -0.43]) and increased physical symptom bother (b = 0.91, p = .023, 95% CI [0.13, 1.69]) across 6 weeks. There were no other significant relationships between perceived subtle discrimination from one's partner and health outcomes at study entry or across time. There were significant associations

between perceived subtle discrimination from one's partner and health outcomes in seven of 15 tested models.

Discussion

In this 12-week study of 101 men and women in treatment for lung cancer, higher internalized stigma and perceived subtle discrimination were uniquely associated with poorer psychological and perceived physical health outcomes at study entry, beyond sociodemographic, medical, and smoking-related characteristics, as hypothesized. Additionally, higher internalized stigma (but not perceived discrimination) predicted significant declines in global quality of life and psychological health outcomes across 6 and 12 weeks. Finally, higher self-compassion and lower avoidant coping significantly attenuated relationships between internalized stigma, perceived discrimination, and poorer psychological health outcomes at study entry, suggesting that higher self-compassion and lower avoidant coping may be protective against the harmful effects of lung cancer-related stigma and discrimination on psychological health outcomes.

Cross-sectional Relationships between Internalized Stigma, Perceived Subtle Discrimination, and Health Outcomes at Study Entry

We hypothesized that higher internalized stigma and perceived subtle discrimination would be associated significantly and uniquely with poorer psychological and physical health outcomes at study entry. Higher internalized stigma and higher perceived discrimination were associated significantly and uniquely with worse global quality of life and higher depressive symptoms; additionally, higher perceived discrimination was associated with higher cancer-related anxiety, statistically controlling for age, sex, race/ethnicity, yearly family income, smoking status, and cancer stage. These findings are consistent with research demonstrating that higher lung cancer stigma is associated with worse global quality of life and poorer

psychological outcomes (Cataldo et al., 2012; Cataldo & Brodsky, 2013; Chambers et al., 2015; Criswell et al., 2016; Gonzalez & Jacobsen, 2012; Lebel et al., 2013). A novel finding is that relationships between higher internalized lung cancer stigma, worse global quality of life, and higher depressive symptoms were independent from perceived discrimination. These results are consistent with the theory that internalized stigma is robustly associated with poorer psychological health outcomes (Chaudoir et al., 2013).

This is the first study to show that higher perceived subtle discrimination is associated with worse global quality of life and poorer psychological health outcomes in adults with lung cancer. These findings are consistent with the broader literature that demonstrates that subtle discrimination is associated with depressive symptoms, anxiety, and poor well-being in adults without cancer (Jones et al., 2016; Pascoe & Smart Richman, 2009). Notably, higher perceived discrimination was associated with higher cancer-related anxiety, whereas internalized stigma was not. These findings suggest that perceived discrimination about one's lung cancer may prompt negative cognitions, hypervigilance, and avoidance about one's lung cancer, which are domains that are captured in the measure of cancer-related anxiety (Blevins et al., 2015). The present study demonstrated non-overlapping relationships between internalized stigma, perceived subtle discrimination, and psychological health outcomes, which is a novel finding.

Zero-order correlations showed that internalized stigma and perceived discrimination were each associated significantly with physical health outcomes at study entry, consistent with other cross-sectional studies (Cataldo & Brodsky, 2013; Criswell et al., 2016). Notably, these relationships were not statistically significant in the fully adjusted model. Such findings are difficult to compare directly to previous research, given that no other study has tested the unique relationships of internalized stigma and perceived discrimination with physical health outcomes.

This pattern of results suggests that internalized stigma and perceived discrimination may be more overlapping with regard to their associations with physical health, as compared to psychological outcomes. However, planned analyses indicated that perceived subtle discrimination from one's partner was associated significantly with poorer global, psychological, and physical health outcomes at study entry, controlling for internalized stigma and covariates. These results are consistent with research demonstrating that negative aspects of intimate relationships can be deleterious for cancer patients' well-being (Manne, Taylor, Dougherty, Kemeny, 1997). The present findings demonstrate that relationships between perceived discrimination and physical health outcomes can vary depending on the social source of perceived discrimination and that perceptions of discrimination from one's partner may be particularly deleterious for lung cancer patients' psychological and physical health. Whether perceived discrimination is an indicator of more global relationship problems requires study.

Overall levels of internalized stigma were low, consistent with research (Criswell et al., 2016; Lebel et al., 2013). It was posited that lung cancer patients would experience subtle discrimination more frequently than overt discrimination. However, overall levels of perceived discrimination were low, although a substantial proportion (49.5%) of participants reported at least one experience of subtle discrimination. Despite low endorsement of stigma and discrimination items, significant and robust relationships between internalized stigma, perceived discrimination, and health outcomes were demonstrated. Regarding covariates, women (vs. men) reported higher cancer-related anxiety and physical symptom bother at study entry, which is consistent with research (Ostroff et al., 2011). Additionally, participants with stage IV (vs. stages I-III) reported worse cancer-specific quality of life at study entry, which is also consistent with research (Gift, Jablonski, Stommel, & Given, 2004).

In sum, internalized stigma and overall perceived subtle discrimination were uniquely and significantly associated with worse global quality of life and poorer psychological outcomes at study entry. Additionally, perceived discrimination specifically from one's partner (but not internalized stigma) was associated significantly with worse global quality of life, poorer psychological health, and poorer physical health at study entry.

Longitudinal Relationships between Internalized Stigma, Perceived Subtle Discrimination, and Health-related Adjustment

We hypothesized that higher internalized stigma and higher perceived subtle discrimination would predict declining psychological and physical health-related adjustment over time. Higher internalized stigma uniquely predicted significant declines in global quality of life and significant increases in cancer-related anxiety at 6- and 12-week follow-up. Higher internalized stigma also predicted significant increases in depressive symptoms across 12 weeks. Researchers have called for longitudinal investigations of lung cancer stigma and health-related adjustment (Criswell et al., 2016; Gonzalez & Jacobsen, 2012), and this is the first study to demonstrate that internalized stigma significantly is associated with declining health-related adjustment in adults with lung cancer, beyond sociodemographic, medical, and smoking-related factors. These temporal relationships support theoretical models of lung cancer stigma (Hamann et al., 2014) in that higher internalized stigma predicts declines in health-related outcomes over time. Additionally, these findings strengthen causal inference that internalized stigma predicts declines in psychological health. An alternative interpretation is that generalized negativity is associated with higher internalized stigma and poorer outcomes. However, this explanation is less likely, given that higher stigma at study entry predicted change in health-related outcomes.

Internalized stigma was not associated with declines in physical health-related adjustment. These findings are consistent with the theory that internalized stigma is particularly deleterious for psychological (vs. physical) health outcomes (Chaudoir et al., 2013). It is possible that internalized stigma may be associated with specific physical symptoms (e.g., pain) that are closely related to cognitions (e.g., catastrophizing; Sullivan et al., 2001) more so than other symptoms (e.g., cough) that are common among lung cancer patients but are not as closely associated with psychological processes. Alternatively, the effect size of the relationship between internalized stigma and declines in physical health may be small, and the current study was underpowered to detect a small effect size.

Overall perceived subtle discrimination was not associated significantly with changes across time in psychological or physical health. However, planned analyses showed that perceived discrimination from one's partner was associated with significant increases in physical symptom bother and declining cancer-specific quality of life across 6 (but not 12) weeks. Additionally, perceived discrimination from one's medical team was associated with significant declines in cancer-specific quality of life across 6 weeks. Perceptions of subtle discrimination from one's medical team may prevent patients from reporting bothersome physical symptoms to their physician or nurse during medical appointments. Similarly, perceptions of discrimination from one's partner may prevent patients from seeking help at home to address distressing physical symptoms. Future studies should assess whether past experiences of subtle discrimination prompt greater anticipated stigma (i.e., fear of negative evaluation or treatment) from others with regard to symptom reporting and help-seeking behavior. Most research has focused on whether discrimination predicts outcomes such as blood pressure or indicators of atherosclerosis, which are relevant to cardiovascular disease (Williams, Neighbors, & Jackson,

2003), and the present findings demonstrate that perceived discrimination, specifically from one's partner or medical team, can also be important for predicting changes in physical symptom bother for lung cancer patients. Couple-based interventions may be helpful in improving psychosocial outcomes for lung cancer patients, particularly if the intervention aims to bolster socially supportive exchanges within the dyad (Manne et al., 2005).

In sum, internalized stigma (vs. perceived discrimination) may be a more potent predictor of declining psychological adjustment to lung cancer, whereas perceived subtle discrimination specifically from one's partner or medical team may be particularly important in predicting physical health-related maladjustment. Indicators of internalized stigma, such as the feelings of shame and regret, may represent negative outcomes of felt stigma—defined as the negative appraisal or evaluation from others (e.g., Hamann et al., 2014)—that are more closely related to poorer health outcomes than perceptions of discrimination. It is possible that the ways in which people react or respond to perceptions of subtle discrimination (e.g., internal attribution, hypervigilance) would be more predictive of poorer health outcomes than the perceptions in and of themselves.

The Moderating Roles of Self-compassion and Coping Strategies

We hypothesized that high self-compassion, low avoidant coping, and high approach-oriented coping would attenuate the relationships between internalized stigma, perceived subtle discrimination, and psychological and physical health outcomes. Specifically, we predicted that significant relationships between higher internalized stigma, higher perceived discrimination, poorer health outcomes would be weaker or statistically nonsignificant for participants who reported high self-compassion, low avoidant coping, and high approach-oriented coping.

Higher self-compassion significantly moderated the relationship between internalized stigma and depressive symptoms as well as the relationship between perceived discrimination and cancer-related anxiety. There was no significant relationship between internalized stigma and depressive symptoms or between perceived discrimination and cancer-related anxiety among participants who reported higher than average levels of self-compassion, but higher internalized stigma and discrimination were related significantly to poorer psychological outcomes among participants who reported relatively low levels of self-compassion. These findings are consistent with research demonstrating that self-compassion can reduce feelings of shame (Albertson et al., 2015), which is a central component of internalized lung cancer stigma (Hamann et al., 2014). Additionally, higher self-compassion may protect lung cancer patients against making internal attributions in response to perceived subtle discrimination, because higher self-compassion involves low levels of self-judgment (Neff, 2003a).

Low avoidant coping also moderated the relationship between perceived subtle discrimination and cancer-related anxiety. There was no significant relationship between perceived discrimination and cancer-related anxiety for participants who reported average or lower than average levels of avoidant coping. Volitional attempts to avoid thoughts and feelings about one's cancer is reciprocally related to intrusive cancer-related thoughts (Bauer et al., 2017). It is possible that perceived subtle discrimination may prompt intrusive thoughts and worries about one's cancer when using avoidance to cope with lung cancer. By contrast, engaging in other processes (such as self-compassion) in response to perceived discrimination may be protective against the occurrence of cancer-related anxiety.

Use of approach-oriented coping strategies did not significantly moderate relationships between internalized stigma, perceived discrimination, and health-related outcomes. Although

approach-oriented coping is generally associated with favorable adjustment to cancer (Hack & Degner, 2004; Roesch et al., 2005; Shapiro et al., 1997; Stanton, Danoff-Burg, et al., 2000), the evidence of approach-coping in buffering against the harmful effects of stigma and discrimination is mixed (Pascoe & Smart Richman, 2009). Approach-oriented coping is a heterogenous construct that encompasses several distinct but related coping strategies such as social support seeking, processing and expressing one's emotions, and problem solving (Miller & Kaiser, 2001; Stanton, Kirk, et al., 2000). It is possible that approach-oriented coping strategies that are focused on managing one's reaction to the stressor (e.g., coping through emotional approach) are more helpful for coping with stigma and discrimination than strategies focused on managing the stressor itself (e.g., problem solving).

It is unclear why self-compassion and coping strategies did not attenuate relationships between internalized stigma and perceived discrimination on global quality of life. A possible explanation is that global quality of life encompasses a broad range of domains (e.g., psychological, physical, social, functional), and the buffering role of these processes may be specific to psychological well-being. Although self-compassion and coping strategies did not moderate relationships between internalized stigma, perceived subtle discrimination, and health outcomes over time, research is needed to test whether experimental manipulations of these psychological processes facilitate positive adjustment to lung cancer. Such an investigation would bolster causal inference on the ability of high self-compassion and low avoidance to buffer the harmful relationship between lung cancer stigma and discrimination on health outcomes.

In sum, higher self-compassion and low avoidant coping may buffer the deleterious effects of stigma and discrimination on psychological health outcomes for lung cancer patients.

This the first study to demonstrate that psychological processes can moderate relationships between lung cancer stigma and health outcomes. These findings inform theoretical perspectives about for whom and under what conditions lung cancer stigma and its associated experiences are particularly harmful (Hamann et al., 2014). Specifically, self-compassion and coping strategies should be considered as moderators of the stigma process in addition to other proposed psychosocial moderators such as social support and religiosity (Hamann et al., 2014). It is possible that high self-compassion and low avoidance may also be associated with low stigma consciousness (i.e., dispositional tendencies to attribute behavior to stigma when there is attributional ambiguity; Pinel, 1999) or shame- and guilt-proneness (i.e., tendency to experience shame and guilt; Tangney, Wagner, Gramzow, 1992)—dispositional traits that are posited to moderate how perceived stigma is internalized (e.g., Bennett, Traub, Mace, Juarascio, & O'Haver, 2016; Miller & Kaiser, 2001). Comprehensive theoretical frameworks of health-related stigma are needed (Deacon, 2006), and these findings from can contribute towards the development of larger theoretical models of health-related stigma. Additionally, interventions that promote self-compassion and reduce avoidant coping may be beneficial in facilitating positive psychological adjustment to lung cancer.

Strengths and Limitations

Although the longitudinal design of the present study strengthens causal inference, causality cannot be inferred. Interventions with the purpose of reducing lung cancer stigma and subsequently improving psychological and physical health outcomes would further strengthen causal inference. Some participant attrition occurred across 12 weeks. However, the retention rate (68%) was comparable to a separate 12-week longitudinal study of lung cancer patients (67%; Thornton et al., 2012). Most participants were non-Hispanic white and caution is

warranted in generalizing these findings broadly. However, race/ethnicity was not associated with internalized stigma, perceived subtle discrimination, or health outcomes at study entry.

There were statistically significant findings in 11 of 42 planned analyses and 15 of 75 exploratory analyses. Some strategies to correct for multiple comparisons (e.g., Bonferroni correction) may reduce statistical power at the expense of a Type II error (Fiedler, Kutzner, & Krueger, 2012), which is especially of concern, given the relatively small sample size in this study. However, future research should use strategies to control for false discovery rates (Benjamini, Krieger, & Yekutieli, 2006), which is a more powerful approach and is recommended when test statistics are positively correlated.

This is the first study to test the unique associations of internalized stigma and perceived subtle discrimination with health-related adjustment. Traditionally, the harmful effects of stigma and discrimination have been investigated in separate research disciplines, prompting calls for researchers to study stigma and discrimination simultaneously with regard to their potentially independent and deleterious effects on health (Stuber, Meyer, & Link, 2008). To this end, our results demonstrate that internalized stigma and perceived subtle discrimination are independently associated with poorer global quality of life and psychological health outcomes. The present study also contributes significantly to the literature by investigating both psychological and physical health outcomes as well as general and cancer-specific indicators of adjustment. Additionally, this is the first study to test whether lung cancer stigma and the associated experience of perceived discrimination predict changes in health outcomes over time, which informs theory (Hamann et al., 2014) and emphasizes the role of stigma and discrimination in predicting declining health-related adjustment, beyond sociodemographic, medical, and smoking-related factors.

Conclusions

This longitudinal investigation demonstrated that internalized lung cancer stigma and perceived subtle discrimination are associated uniquely and significantly with poorer psychological and physical health outcomes at study entry and over time. Specifically, these findings highlight the importance of internalized lung cancer stigma in predicting declining psychological health outcomes across time and of perceived subtle discrimination from one's partner or medical team as important in predicting declining physical health outcomes. Higher self-compassion and lower avoidant coping were identified as malleable psychological processes that can attenuate the relationship between lung cancer stigma and discrimination on psychological health outcomes.

These findings provide guidance for future interventions that aim to reduce lung cancer stigma and promote health and well-being for lung cancer patients. Existing interventions that focus on cultivating mindfulness—such as mindfulness-based stress reduction (Grossman, Niemann, Schidt, & Walach, 2004; Kabat-Zinn, 2003) and mindful self-compassion (Neff & Germer, 2013—have been shown to reduce avoidance and increase self-compassion and can be tailored specifically to address disease-relevant issues in lung cancer. For example, lung cancer patients who have high internalized stigma may benefit from learning how to notice and label self-critical and self-judgmental cognitions (e.g., "I know I got this cancer because I smoked"; "I feel like I did this to myself") and replace them with a more compassionate and understanding way of relating to oneself (e.g., "Lung cancer is stressful and I am doing the best I can to help get myself through this difficult time"). Additionally, strategies from cognitive-behavioral therapy (e.g., cognitive restructuring; Butler, Chapman, Forman, & Beck, 2006) may be helpful for patients in generating cognitions that may reduce avoidance and stigma about lung cancer

(e.g., “Anyone with lungs can get lung cancer”). Finally, provider-focused (e.g., empathic communication skills training; Pehrson et al., 2016) and couple-based interventions (e.g., bolstering socially supportive exchanges; Manne et al., 2005) may also be helpful in reducing stigma and, in turn, promoting well-being for cancer patients in ways that embrace interpersonal pathways of intervention (Hamann, Ver Hoeve, Carter-Harris, Studts, & Ostroff, 2018). Given the paucity of psychosocial interventions for lung cancer patients, supportive care efforts that aim to reduce lung cancer stigma may also promote health in this patient population.

The current findings support theoretical models of lung cancer stigma in that higher stigma and discrimination predicted poorer health-related adjustment cross-sectionally and across time. Additionally, these findings inform the broader literature of health-related stigma in several ways. First, this is one of few studies to analyze disease-specific stigma and discrimination as unique, independent contributors to health and well-being (Deacon, 2006). Second, these findings encourage the assessment of perceived stigma and/or discrimination from a variety of social sources (e.g., family, friends, partner, medical team), given that there may be differences in levels of stigma perceived and the strength of association between stigma and health-related outcomes by social source. Specifically, our findings indicate that perceived discrimination from one’s medical team and/or partner may be particularly detrimental for psychological and physical health outcomes for patients living with a stigmatized chronic disease. Third, the inclusion of additional psychosocial moderators (e.g., coping processes, self-compassion) in theoretical models of health-related stigma may help to identify modifiable processes that can be harnessed through interventions to reduce stigma and improve health.

Future research should also test whether lung cancer stigma and discrimination are associated with patient engagement in care, as is hypothesized (Hamann et al., 2014). There are

several opportunities for lung cancer patients to be engaged with their care at various phases of the cancer care trajectory including at diagnosis, during active treatment, or at the end-of-life. As such, research is needed to determine whether higher stigma interferes with patient engagement outcomes such as accepting a referral to a tobacco cessation clinic at diagnosis, discussing therapeutic clinical trial participation, and having an advanced directive at the end-of-life. Such outcomes are important to study, given their associations with better quality of life, higher satisfaction with medical care, and lower health care utilization costs.

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Table 1

Sample characteristics and demographics (N = 101)

		n	Mean	Standard Deviation
Age (in years)		101	64.54	11.60
Years of Education		93	15.69	2.83
Internalized Stigma		98	2.42	1.17
Perceived subtle discrimination		99	0.17	0.29
CES-D depressive symptoms at study entry		99	17.57	4.02
FACT-G Global quality of life at study entry		99	57.15	16.80
FACT-L Lung-cancer specific quality of life at study entry		99	19.90	5.32
PCL Cancer-related anxiety		98	29.72	9.68
MSAS Physical symptom bother		101	0.76	0.71
SCS Self-compassion		98	44.71	8.50
COPE Approach-oriented coping		100	2.88	0.57
COPE Avoidant coping		100	1.74	0.39
		n	Median	Interquartile Range
Months since lung cancer diagnosis		101	9.97	17.38
Days since beginning current treatment		100	29.00	168.25
		n	%	
Sex				
	Male	53	52.5	
	Female	48	47.5	
Race/Ethnicity				
	Non-Hispanic white	72	71.3	
	Other race/ethnicity	29	28.7	
Marital status				
	Married/Living as married	66	65.3	
	Not married	34	33.7	
	Did not report	1	1.0	
Yearly family income				
	>$100,000	52	51.5	
	$65,000-$99,999	18	17.8	
	<$65,000	28	27.7	
	Did not report	3	3.0	
Smoking status				
	Current	8	7.9	
	Former	56	55.4	
	Never	37	36.6	
Cancer type				
	Non-small cell lung cancer	90	89.1	
	Other lung cancer type	11	10.9	

Stage of disease			
	Stage I or II	7	7.0
	Stage III	18	17.8
	Stage IV	74	73.3
	Missing	2	2.0
Current participation in oncologic clinical trial			
	Yes	55	54.4
	No	45	44.6
	Missing	1	1.0
Current oncologic treatment			
	Immunotherapy only	49	48.5
	Chemotherapy only	24	23.8
	Targeted therapy only	8	7.9
	Combination therapy	20	19.8
Line of current oncologic treatment			
	First	48	47.4
	Second	22	21.8
	Third	16	15.8
	Fourth or fifth	14	14.9
	Missing	1	1.0
History of lung cancer-related surgery			
	Yes	29	28.7
	No	71	70.3
	Missing	1	1.0
Past receipt of chemotherapy for lung cancer			
	Yes	48	47.5
	No	52	51.5
	Missing	1	1.0

Note: CES-D = Center for Epidemiologic Studies-Depression scale. FACT-G = Functional Assessment of Cancer Therapy-General Scale. FACT-L = Functional Assessment of Cancer Therapy-Lung Subscale. PCL = Posttraumatic Stress Disorder Checklist for DSM-5. MSAS = Memorial Symptom Assessment Scale. SCS = Self-compassion Scale.

Table 2

Pearson's product moment correlations between dependent variables at study entry

Dependent Variable		1	2	3	4
1	Depressive symptoms	--			
2	Global quality of life	-.80	--		
3	Cancer-specific quality of life	-.55	.65	--	
4	Cancer-related anxiety	-.66	.69	-.46	--
5	Physical Symptom Bother	.72	.77	-.63	.65

Note: all correlations are statistically significant at $p < .001$.

Table 3

Internalized stigma and perceived subtle discrimination as predictors of global quality of life at study entry

	Global Quality of Life at Study Entry			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**72.09**	**6.67**	**<.001**	**[50.92, 93.27]**
Age (in years)	0.25	1.79	.073	[-0.02, 0.53]
Sex (female vs. male)	-5.17	-1.65	.098	[-11.30, 0.96]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	3.20	0.97	.334	[-3.30, 9.71]
Family Income (above vs. below $100K/yr)	1.25	0.38	.706	[-5.27, 7.78]
Smoking history (current/former vs. never)	6.51	1.83	.067	[-0.46, 13.48]
Cancer stage (stage IV vs. stages I-III)	-5.13	-1.41	.160	[-12.29, 2.02]
Internalized stigma	**-3.70**	**-2.40**	**.017**	**[-6.73, -0.67]**
Perceived subtle discrimination	**-22.37**	**-3.60**	**<.001**	**[-34.57, -10.18]**

Note: N = 101. Global quality of life at study entry was entered as the dependent variable.

b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval.

Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 4

Internalized stigma and perceived subtle discrimination as predictors of depressive symptoms at study entry

	Depressive Symptoms at Study Entry			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**14.55**	**2.33**	**.020**	**[2.32, 26.78]**
Age (in years)	-0.11	-1.38	.166	[-0.27, 0.05]
Sex (female vs. male)	2.26	1.25	.211	[-1.28, 5.79]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-1.76	-0.92	.358	[-5.52, 2.00]
Family Income (above vs. below $100K/yr)	-0.29	-0.15	.879	[-4.05, 3.47]
Smoking history (current/former vs. never)	-2.47	-1.20	.228	[-6.50, 1.55]
Cancer stage (stage IV vs. stages I-III)	3.19	1.50	.132	[-0.97, 7.34]
Internalized stigma	**1.93**	**2.14**	**.033**	**[0.16, 3.70]**
Perceived subtle discrimination	**7.65**	**2.14**	**.032**	**[0.64, 14.67]**

Note: N = 101. Depressive symptoms at study entry was entered as the dependent variable.

b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval.

Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 5

Internalized stigma and perceived subtle discrimination as predictors of cancer-specific anxiety at study entry

	Cancer-Specific Anxiety at Study Entry			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**33.70**	**5.94**	**<.001**	**[22.06, 45.34]**
Age (in years)	-0.13	-1.66	.098	[-0.28, 0.02]
Sex (female vs. male)	**3.73**	**2.16**	**.031**	**[0.35, 7.11]**
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-2.43	-1.33	.184	[-6.00, 1.15]
Family Income (above vs. below $100K/yr)	-2.90	-1.60	.110	[-6.45, 0.66]
Smoking history (current/former vs. never)	-1.21	-0.62	.538	[-5.04, 2.63]
Cancer stage (stage IV vs. stages I-III)	0.56	0.28	.778	[-5.16, -0.41]
Internalized stigma	1.62	1.90	.057	[-0.05, 3.28]
Perceived subtle discrimination	**11.29**	**3.29**	**.001**	**[4.84, 17.73]**

Note: N = 101. Cancer-specific anxiety at study entry was entered as the dependent variable.

b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval.

Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 6

Internalized stigma and perceived subtle discrimination as predictors of lung cancer-related quality of life at study entry

	Lung Cancer-related Quality of Life at Study Entry			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**22.36**	**6.28**	**<.001**	**[50.92, 93.27]**
Age (in years)	0.02	0.40	.689	[-0.07, 0.11]
Sex (female vs. male)	-1.25	1.09	.225	[-3.27, 0.77]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	1.19	1.09	.276	[-0.95, 3.34]
Family Income (above vs. below $100K/yr)	0.15	0.13	.894	[-1.99, 2.28]
Smoking history (current/former vs. never)	-0.44	-0.38	.705	[-2.74, 1.85]
Cancer stage (stage IV vs. stages I-III)	**-2.79**	**-2.30**	**.022**	**[-5.16, -0.41]**
Internalized stigma	-0.91	-1.78	.075	[-1.90, 0.09]
Perceived subtle discrimination	-1.89	-0.92	.358	[-5.90, 2.13]

Note: N = 101. Lung cancer-related quality of life at study entry was entered as the dependent variable. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 7

Internalized stigma and perceived subtle discrimination as predictors of physical symptom bother at study entry

	Physical Symptom Bother at Study Entry			
Predictor	*b*	*z*	*p*	95% CI
Intercept	0.79	1.74	.082	[-0.10, 1.68]
Age (in years)	-0.01	-0.91	.365	[-0.02, 0.01]
Sex (female vs. male)	**0.39**	**2.91**	**.004**	**[0.13, 0.65]**
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.11	-0.78	.433	[-0.39, 0.17]
Family Income (above vs. below $100K/yr)	-0.13	-0.92	.355	[-0.41, 0.15]
Smoking history (current/former vs. never)	-0.07	-0.44	.662	[-0.37, 0.23]
Cancer stage (stage IV vs. stages I-III)	0.24	1.52	.129	[-0.07, 0.54]
Internalized stigma	0.05	0.81	.416	[-0.08, 0.19]
Perceived subtle discrimination	0.51	1.88	.060	[-0.02, 1.04]

Note: N = 101. Physical symptom bother at study entry was entered as the dependent variable.

b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval.

Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 8

Internalized stigma and perceived subtle discrimination as predictors of global quality of life at 6-week follow-up

	Global Quality of Life at 6-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**41.63**	**4.22**	**<.001**	**[22.30, 60.95]**
Global quality of life at study entry	**0.60**	**7.13**	**<.001**	**[-0.29, 0.17]**
Age (in years)	-0.06	-0.51	.610	[-0.29, 0.17]
Sex (female vs. male)	-0.97	-0.37	.714	[-6.18, 4.23]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	**8.30**	**2.95**	**.003**	**[2.78, 13.82]**
Family Income (above vs. below $100K/yr)	-2.49	-0.91	.365	[-7.88, 2.90]
Smoking history (current/former vs. never)	1.98	0.66	.509	[-3.90, 7.87]
Cancer stage (stage IV vs. stages I-III)	0.08	0.03	.979	[-6.13, 6.30]
Internalized stigma	**-2.92**	**-2.14**	**.032**	**[-5.59, -0.25]**
Perceived subtle discrimination	0.22	0.04	.967	[-10.12, 10.55]

Note: N = 101. Global quality of life at 6-week follow-up was entered as the dependent variable. To assess change, the study entry value of global quality of life was entered as a covariate.

b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval.

Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 9

Internalized stigma and perceived subtle discrimination as predictors of cancer-specific anxiety at 6-week follow-up

	Cancer-specific Anxiety at 6-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	-2.18	-0.29	.770	[-16.77, 12.41]
Cancer-specific anxiety at study entry	**0.61**	**5.03**	**<.001**	**[0.37, 0.84]**
Age (in years)	0.08	0.95	.342	[-0.08, 0.23]
Sex (female vs. male)	2.14	1.20	.232	[-1.37, 5.64]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-1.43	-0.74	.461	[-5.24, 2.38]
Family Income (above vs. below $100K/yr)	2.23	1.17	.241	[-1.50, 5.96]
Smoking history (current/former vs. never)	-2.24	-1.13	.258	[-6.13, 1.65]
Cancer stage (stage IV vs. stages I-III)	2.51	1.24	.215	[-1.46, 6.47]
Internalized stigma	**2.68**	**3.05**	**.002**	**[0.96, 4.41]**
Perceived subtle discrimination	-0.46	-0.13	.896	[-7.40, 6.48]

Note: N = 101. Cancer-specific anxiety at 6-week follow-up was entered as the dependent variable. To assess change, the study entry value of cancer-specific anxiety was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 10

Internalized stigma and perceived subtle discrimination as predictors of depressive symptoms at 6-week follow-up

	Depressive Symptoms at 6-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	3.82	0.76	.450	[-6.08, 13.71]
Depressive symptoms at study entry	**0.55**	**6.17**	**<.001**	**[0.37, 0.72]**
Age (in years)	-0.01	-0.14	.885	[-0.14, 0.12]
Sex (female vs. male)	1.98	1.31	.191	[-0.99, 4.96]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-1.95	-1.24	.217	[-5.04, 1.14]
Family Income (above vs. below $100K/yr)	-0.98	-0.65	.518	[-3.95, 1.99]
Smoking history (current/former vs. never)	0.05	0.03	.977	[-3.20, 3.30]
Cancer stage (stage IV vs. stages I-III)	-0.95	1.52	.130	[-0.34, 2.63]
Internalized stigma	1.15	1.52	.130	[-0.34, 2.63]
Perceived subtle discrimination	1.15	0.40	.692	[-4.56, 6.87]

Note: N = 101. Depressive symptoms at 6-week follow-up was entered as the dependent variable. To assess change, the study entry value of depressive symptoms was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 11

Internalized stigma and perceived subtle discrimination as predictors of lung cancer-related quality of life at 6-week follow-up

	Lung Cancer-related Quality of Life at 6-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**13.48**	**4.23**	**<.001**	**[7.24, 19.71]**
Lung cancer-related quality of life at study entry	**0.57**	**6.79**	**<.001**	**[0.41, 0.74]**
Age (in years)	-0.04	-1.02	.307	[-0.11, 0.03]
Sex (female vs. male)	0.70	0.82	.410	[-0.97, 2.37]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	0.87	0.93	.351	[-0.96, 2.70]
Family Income (above vs. below $100K/yr)	-0.75	-0.84	.402	[-2.52, 1.01]
Smoking history (current/former vs. never)	-0.70	-0.73	.462	[-2.55, 1.16]
Cancer stage (stage IV vs. stages I-III)	-0.36	-0.33	.738	[-2.44, 1.73]
Internalized stigma	-0.65	-1.46	.143	[-1.51, 0.22]
Perceived subtle discrimination	-0.36	-0.21	.833	[-3.67, 2.95]

Note: N = 101. Lung cancer-related quality of life at 6-week follow-up was entered as the dependent variable. To assess change, the study entry value of lung cancer-related quality of life was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 12

Internalized stigma and perceived subtle discrimination as predictors of physical symptom bother at 6-week follow-up

	Physical Symptom Bother at 6-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	0.42	1.10	.270	[-0.33, 1.17]
Physical symptom bother at study entry	**0.40**	**4.22**	**<.001**	**[0.21, 0.59]**
Age (in years)	<-0.01	-0.44	.659	[-0.01, 0.01]
Sex (female vs. male)	-0.06	-0.48	.633	[-0.29, 0.18]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.25	-1.95	.051	[-0.50, <0.01]
Family Income (above vs. below $100K/yr)	0.16	1.35	.178	[-0.07, 0.40]
Smoking history (current/former vs. never)	-0.08	-0.60	.548	[-0.33, 0.18]
Cancer stage (stage IV vs. stages I-III)	0.15	1.08	.282	[-0.12, 0.43]
Internalized stigma	0.04	0.75	.435	[-0.07, 0.16]
Perceived subtle discrimination	-0.08	-0.33	.742	[-0.54, 0.38]

Note: N = 101. Physical symptom bother at 6-week follow-up was entered as the dependent variable. To assess change, the study entry value of physical symptom bother was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 13

Internalized stigma and perceived subtle discrimination as predictors of global quality of life at 12-week follow-up

	Global Quality of Life at 12-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**30.37**	**2.45**	**.014**	**[6.05, 54.69]**
Global quality of life at study entry	**0.71**	**6.77**	**<.001**	**[0.50, 0.91]**
Age (in years)	-0.09	-0.57	.566	[-0.38, 0.21]
Sex (female vs. male)	0.67	0.21	.833	[-5.52, 6.85]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	4.81	1.49	.136	[-1.51, 11.13]
Family Income (above vs. below $100K/yr)	5.50	1.68	.094	[-0.94, 11.94]
Smoking history (current/former vs. never)	2.33	0.65	.515	[-4.69, 9.36]
Cancer stage (stage IV vs. stages I-III)	3.79	0.99	.320	[-3.68, 11.25]
Internalized stigma	**-3.79**	**-2.30**	**.022**	**[-6.36, -0.51]**
Perceived subtle discrimination	5.19	0.82	.411	[-7.12, 17.40]

Note: N = 101. Global quality of life at 12-week follow-up was entered as the dependent variable. To assess change, the study entry value of global quality of life was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 14

Internalized stigma and perceived subtle discrimination as predictors of depressive symptoms at 12-week follow-up

	Depressive Symptoms at 12-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	-9.58	-1.39	.164	[-23.06, 3.90]
Depressive symptoms at study entry	**0.52**	**4.76**	**<.001**	**[0.30, 0.73]**
Age (in years)	0.15	1.72	.086	[-0.02, 0.32]
Sex (female vs. male)	**3.83**	**2.08**	**.038**	**[0.21, 7.44]**
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.55	-0.28	.776	[-4.32, 3.22]
Family Income (above vs. below $100K/yr)	0.38	0.20	.842	[-3.38, 4.14]
Smoking history (current/former vs. never)	-0.82	-0.39	.695	[-4.92, 3.28]
Cancer stage (stage IV vs. stages I-III)	-2.29	-1.03	.304	[-6.65, 2.07]
Internalized stigma	**2.01**	**2.27**	**.023**	**[0.27, 3.75]**
Perceived subtle discrimination	4.06	0.86	.390	[-5.20, 13.33]

Note: N = 101. Depressive symptoms at 12-week follow-up was entered as the dependent variable. To assess change, the study entry value of depressive symptoms was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 15

Internalized stigma and perceived subtle discrimination as predictors of cancer-specific anxiety at 12-week follow-up

	Cancer-specific Anxiety at 12-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	-8.42	-1.33	.182	[-20.79, 3.95]
Cancer-specific anxiety at study entry	**0.88**	**8.66**	**<.001**	**[0.68, 1.08]**
Age (in years)	**0.14**	**2.13**	**.033**	**[0.01, 0.27]**
Sex (female vs. male)	0.39	0.26	.792	[-2.50, 3.29]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-2.19	-1.43	.153	[-5.18, 0.81]
Family Income (above vs. below $100K/yr)	-1.06	-0.67	.503	[-4.16, 2.04]
Smoking history (current/former vs. never)	-2.60	-1.59	.111	[-5.79, 0.59]
Cancer stage (stage IV vs. stages I-III)	-0.27	-0.16	.874	[-3.67, 3.12]
Internalized stigma	**2.52**	**3.61**	**<.001**	**[1.15, 3.89]**
Perceived subtle discrimination	1.82	0.60	.552	[-4.17, 7.81]

Note: N = 101. Cancer-specific anxiety at 12-week follow-up was entered as the dependent variable. To assess change, the study entry value of cancer-specific anxiety was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 16

Internalized stigma and perceived subtle discrimination as predictors of lung cancer-related quality of life at 12-week follow-up

	Lung Cancer-related Quality of Life at 12-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**10.91**	**2.41**	**.016**	**[2.05, 19.77]**
Lung cancer-related quality of life at study entry	**0.50**	**4.12**	**<.001**	**[0.26, 0.73]**
Age (in years)	-0.03	-0.60	.547	[-0.13, 0.07]
Sex (female vs. male)	1.24	1.07	.286	[-1.04, 3.53]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	1.45	1.22	.222	[-0.88, 3.78]
Family Income (above vs. below $100K/yr)	**2.57**	**2.19**	**.029**	**[0.27, 4.88]**
Smoking history (current/former vs. never)	1.25	0.97	.333	[-1.28, 3.77]
Cancer stage (stage IV vs. stages I-III)	-0.98	-0.70	.482	[-3.69, 1.74]
Internalized stigma	-0.74	-1.33	.182	[-1.83, 0.35]
Perceived subtle discrimination	0.40	0.17	.866	[-4.21, 5.01]

Note: N = 101. Lung cancer-related quality of life at 12-week follow-up was entered as the dependent variable. To assess change, the study entry value of lung cancer-related quality of life was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 17

Internalized stigma and perceived subtle discrimination as predictors of physical symptom bother at 12-week follow-up

	Physical Symptom Bother at 12-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	-0.09	-0.17	.865	[-1.00, 0.84]
Physical symptom bother at study entry	**0.52**	**4.48**	**<.001**	**[0.29, 0.75]**
Age (in years)	<0.01	0.67	.501	[-0.01, 0.02]
Sex (female vs. male)	0.06	0.49	.625	[-0.19, 0.32]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.16	-1.19	.236	[-0.41, 0.10]
Family Income (above vs. below $100K/yr)	-0.08	-0.59	.552	[-0.34, 0.18]
Smoking history (current/former vs. never)	0.02	0.14	.892	[-0.26, 0.30]
Cancer stage (stage IV vs. stages I-III)	-0.07	-0.43	.666	[-0.40, 0.26]
Internalized stigma	0.10	1.64	.100	[-0.02, 0.21]
Perceived subtle discrimination	-0.16	-0.61	.540	[-0.68, 0.36]

Note: N = 101. Physical symptom bother at 12-week follow-up was entered as the dependent variable. To assess change, the study entry value of physical symptom bother was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Chapter 3: Sleep disturbance as a mediator of lung cancer stigma on health-related adjustment (Study 2)

Abstract

Objective: Stigma and discrimination are well-established predictors of poor mental and physical health. Understanding the mechanisms through which these processes are harmful for health will advance theory and identify targets for intervention. This study focused on sleep disturbance as a mediator through which stigma and discrimination predict poor health in adults with lung cancer, a stigmatized chronic disease.

Method: A sample of lung cancer patients (N = 101, 52.4% male, mean [SD] age = 64.5 [11.6] years) on active oncologic treatment completed questionnaires on stigma, discrimination, sleep behavior (e.g., duration, efficiency, quality, disturbances), and health-related adjustment at study entry and at 6- and 12-week follow-up. A subset of participants (N = 30) also continuously wore an actigraph for seven days at the 6-week assessment to measure objective sleep behavior. Mediation analyses were conducted to investigate whether lung cancer-related stigma and discrimination at study entry predicted poor health across 12 weeks through disrupted sleep.

Results: Higher perceived subtle discrimination was associated significantly with higher subjective global sleep disturbance and with a significant increase in sleep disturbance across 6 and 12 weeks (all $p < .04$). Higher internalized stigma was correlated significantly with longer objective sleep duration ($p = .047$), whereas higher perceived discrimination was associated significantly with shorter objective sleep duration ($p = .017$). Higher subjective global sleep disturbance was associated with poorer health-related adjustment across all outcomes (all $p < .05$). At study entry, higher subjective global sleep disturbance significantly mediated the association between higher perceived subtle discrimination and higher depressive symptoms,

worse global quality of life, poorer cancer-specific quality of life, higher cancer-related anxiety, and higher physical symptom bother (all $p < .02$). Furthermore, subjective daily disturbance (but not sleep efficiency or perceived sleep quality) uniquely and significantly explained the relationship between higher perceived subtle discrimination and worse health-related outcomes (all $p < .04$). Sleep disturbance did not mediate relationships between stigma, discrimination, and changes in health outcomes across time.

Conclusions: Overall, lung cancer patients evidenced pronounced subjective and objective sleep impairment, and subjective sleep disturbance was robustly associated with poorer health-related adjustment. Although subjective sleep disturbance significantly explained cross-sectional relationships between perceived discrimination and poorer health-related outcomes at study entry, further research is needed to evaluate the mechanisms through which internalized lung cancer stigma influences poorer health outcomes and how stigma and discrimination predict health-related adjustment across time.

Sleep disturbance as a mediator of lung cancer stigma on health-related adjustment

Stigma is a complex social phenomenon that entails the recognition of a difference followed by devaluation of the stigmatized person's character or identity (Dovidio, Major, & Crocker, 2000). Stigmatization can result in several negative interpersonal and intrapersonal processes including perceived discrimination (i.e., perceiving discriminatory interactions from social situations; Acevedo-Garcia, Rosenfeld, Hardy, McArdle, & Osypuk, 2013) and internalized stigma (i.e., directing negative societal attitudes towards oneself; Stuber, Meyer, & Link, 2008). Perceived discrimination and internalized stigma are associated with adverse psychological and physical health outcomes (for meta-analyses, see Livingston & Boyd, 2010; Logie & Gadalla, 2009; Mak, Poon, Pun, & Cheung, 2007; Pascoe & Smart Richman, 2009; Schmitt, Branscombe, Postmes, & Garcia, 2014). Research to understand the mechanisms through which these processes are harmful for health is accumulating.

Health behaviors have consistently been theorized as pathways through which stigma and discrimination predict poor health outcomes (Jackson & Knight, 2006; Lick, Durso, & Johnson, 2013). Sleep, specifically, may be an important health behavior in explaining stigma-related health consequences. Stigma and discrimination are frequently conceptualized as psychosocial stressors (e.g., Meyer, 2003; Slopen & Williams, 2014), and sleep is robustly characterized as a pathway through which stress predicts poor health (e.g., Chrousos, 2009; Mohr et al., 2003; Moore, Adler, Williams, & Jackson, 2002). Therefore, the purpose of the present study was to investigate sleep disturbance as a mediator of the relationships of perceived discrimination and internalized stigma with health-related adjustment. The present study focused on adults with lung cancer, a medical population that evidences stigma (for review, see Chambers et al., 2012), sleep disturbance (Le Guen et al., 2007; Vena et al., 2006), and compromised psychological and

physical health (e.g., Akin, Can, Aydiner, Ozdilli, & Durna, 2010; Fox & Lyon, 2006; Hopwood & Stephens, 2000).

Lung cancer patients are frequently stigmatized due to the association of lung cancer with smoking behavior and the perception of the disease as self-caused (Chambers et al., 2012). Lung cancer-related stigma and discrimination are associated with depressive symptoms, bothersome physical symptoms, poor quality of life, and psychological distress (Cataldo & Brodsky, 2013; Cataldo, Jahan, & Pongquan, 2012; Chambers et al., 2015; Criswell, Owen, Thornton, & Stanton, 2016; Gonzales & Jacobsen, 2012). Characterizing the mechanisms that explain these relationships is important for advancing theory and identifying targets amenable to intervention. Poor sleep behavior is a particularly important mediator to investigate given that it is associated with myriad adverse psychological and physical health outcomes including depression (Baglioni et al., 2011; Cho et al., 2008), lower self-rated health (Steptoe, Peacey, & Wardle, 2006), and mortality (Gallicchio & Kalesan, 2009) in the general population.

Lung cancer patients evidence high rates of sleep disturbance, compared with medically healthy adults (Gooneratne et al., 2007; Grutsch, Wood, et al., 2011; Le Guen et al., 2007; Levin et al., 2005; Vena et al., 2006) and compared with other cancer patient samples (Davidson, MacLean, Brundage, & Schulze, 2002), perhaps due persistent cough and pain (Molassiotis et al., 2011) or pre-sleep worry (M. Chen, Yu, & Yang, 2008). Furthermore, poor sleep is associated with symptoms of anxiety and depression, more physical symptoms, poor functional status, and low quality of life in lung cancer patients (M. Chen et al., 2008; Du-Quiton et al., 2010; Gooneratne et al., 2007; Grutsch, Ferrans, et al., 2011; Le Guen et al., 2007; Levin et al., 2005; Vena et al., 2006). No study has investigated whether internalized stigma and perceived

discrimination are associated with poor sleep in lung cancer patients. However, a wider body of research has assessed the relationships between discrimination and sleep.

A recent systematic review of 17 studies demonstrates that discrimination is reliably associated with poor sleep (Slopen, Lewis, & Williams, 2016). The majority of included studies assessed perceived subtle discrimination, which is discriminatory behavior from social interactions that is "ambiguous in intent to harm, difficult to detect, low in intensity, and often unintentional" (Jones, Peddie, Gilrane, King, & Gray, 2016, p.1589). Correlational findings indicate that perceived subtle discrimination is associated with more self-reported sleep difficulties (Lewis et al., 2013; Slopen & Williams, 2014), poor sleep quality (Beatty et al., 2011; Huynh, 2012), more daytime fatigue (Beatty et al., 2011), and shorter sleep duration (Huynh, 2012; Slopen & Williams, 2014). Two of these studies also assessed objective measures of sleep behavior (e.g., wrist actigraphy, polysomnography) in addition to self-reported outcomes. Results suggest that higher perceived discrimination is associated with shorter sleep duration, less sleep efficiency (i.e., the proportion of time asleep vs. time in bed), and more wakefulness after sleep onset (Beatty et al., 2011; Lewis et al., 2013). Multi-method measurement of sleep is important for characterizing sleep parameters that are difficult to assess via self-report such as wakefulness after sleep onset. Continued research is needed that includes objective and subjective measures of sleep to better understand the health-related consequences of discrimination and stigma.

The review by Slopen and colleagues (2016) also includes four longitudinal studies (Elovainio et al., 2009; Elovainio, Kivimäki, Vahtera, Keltikangas-Järvinen, & Virtanen, 2003; Lewis et al., 2013), and each provides support for the hypothesized temporal relationship of discrimination predicting poor sleep. However, three of these studies conceptualized

discrimination as procedural or organizational justice, which may reflect the structural consequences rather than the inter- or intrapersonal processes that result from stigmatization. One recent prospective study showed that perceived subtle discrimination predicts increases in subjective sleep problems across 18 months (Fuller-Rowell et al., 2016), and additional longitudinal research on perceived subtle discrimination and sleep outcomes is needed to bolster causal inference.

In the context of lung cancer, internalized stigma involves feelings of self-blame, shame, guilt, and regret (for review, see Chambers et al., 2012). Evidence from correlational studies suggests that these feelings are associated with impaired sleep. Feelings of regret are strongest at night (Schmidt, Renaud, & Van der Linden, 2011), and regret is related to poor sleep quality and more sleep problems in older adults (Schmidt et al., 2011; Wrosch, Bauer, Miller, & Lupien, 2007). In another study, participants who endorsed higher levels of regret, shame, and guilt while trying to fall asleep evidenced impairments in sleep quality (Schmidt & Van der Linden, 2009). Experimental evidence also indicates that feelings of regret result in longer sleep latency (i.e., time it takes to fall asleep; Schmidt & Van Der Linden, 2013). Self-blame is also associated with poor sleep quality (Guan, Zhang, & Wang, 2008; Wu, Zhang, & Deng, 2003) and self-attacking thoughts are related to more sleep problems (Schmidt et al., 2011). Taken together, these findings indicate that regret, self-blame, shame, and guilt predict poor sleep. Given that lung cancer patients internalize stigma through these feelings, it is likely that internalized lung cancer stigma is related to poor sleep.

Perceived discrimination and internalized stigma may predict poor sleep outcomes through cognitive, affective, and physiological processes that interfere with restful sleep. Specifically, research demonstrates higher perceived stress (Huynh & Gillen-O'Neel, 2013) and

rumination (Beatty et al., 2011) mediate the relationship between perceived discrimination and poor sleep. Perceived stress and rumination are both cognitive-affective processes that activate physiological stress responses (e.g., Byrd-Craven, Granger, & Auer, 2011; Kemeny, 2003) and prevent restful sleep (Åkerstedt, 2006; Thomsen, Mehlsen, Christensen, & Zachariae, 2003). Internalized stigma is associated with higher perceived stress (Fredriksen-Goldsen et al., 2014), and stigma-related stress is associated with greater rumination (Hatzenbuehler, Nolen-Hoeksema, & Dovidio, 2009). However, the direct relationship between internalized stigma and poor sleep has not been studied in any population, to our knowledge.

Aims of the Proposed Study

Existing theory and research has indicated relationships between higher stigma and discrimination and poorer sleep, and the links between sleep and health-related adjustment are well-established. The literature is limited in several ways, however. Facets of stigma and discrimination have been traditionally examined as predictors in separate studies, and researchers have called for investigations that include both predictors simultaneously to better characterize the health consequences of stigma and discrimination (Stuber et al., 2008). Additionally, only two studies have tested sleep disturbance as a mediator between discrimination and health (D. Chen & Yang, 2014; Steffen & Bowden, 2006). More research using mediation analysis is needed to integrate the relationships between stigma, discrimination, and sleep with the robust associations between sleep disturbance and poor health. In the two aforementioned studies, objective measures of sleep were not assessed, and each study analyzed either a psychological *or* physical health outcome variable (D. Chen & Yang, 2014; Steffen & Bowden, 2006). In the present study, we measured objective and subjective sleep behavior to provide a multi-method assessment of sleep disturbance as a mediator. Additionally, we analyzed psychological *and*

physical health-related outcomes, which will further the understanding of sleep disturbance as a mechanism through which stigma and discrimination predict poor health. The present longitudinal study tested subjective and objective measures of sleep disturbance as mechanisms through which internalized stigma and perceived discrimination predict psychological and physical health-related adjustment across 12 weeks in a sample of lung cancer patients.

Aim 1. The first aim of the present study was to investigate whether sleep disturbance was associated significantly with health-related adjustment and if stigma and discrimination were associated significantly with sleep disturbance at study entry and across time.

Hypothesis 1a. Higher sleep disturbance will be associated significantly with poorer psychological (i.e., depressive symptoms, anxiety symptoms, global quality of life) and physical health outcomes (i.e., cancer-specific quality of life, bothersome physical symptoms) at each assessment.

Hypothesis 1b. Higher internalized stigma and perceived subtle discrimination will be associated significantly with more sleep disturbance (i.e., self-reported sleep impairment, objective sleep characteristics) at study entry and across 12 weeks, controlling for sociodemographic and medical characteristics.

Aim 2. The second aim of the present study was to test whether subjective sleep disturbance mediated the relationship between internalized stigma, perceived subtle discrimination, and psychological and physical health outcomes.

Hypothesis 2. Subjective sleep disturbance will significantly mediate the relationships between internalized stigma, perceived subtle discrimination, and health-related outcomes at study entry and across 12 weeks.

Aim 3. The third aim of the present study was to test whether objective sleep disturbance mediated the relationship between internalized stigma and perceived subtle discrimination on health-related adjustment.

Hypothesis 3. Objective sleep disturbance measured through actigraphy will mediate the relationships between internalized stigma, perceived subtle discrimination, and health-related outcomes cross-sectionally and across time.

Method

Participants

Men and women diagnosed with lung cancer were recruited to participate in the study through the UCLA Hematology/Oncology clinic. Patients were eligible if they were: 1) diagnosed with lung cancer (any type, any diagnosis duration); 2) receiving active oncologic treatment; 3) at least 18 years of age; and 4) comfortable reading and responding to questions in English. Participants undergoing any oncologic treatment for lung cancer were allowed to participate. Participants were ineligible if cognitive impairment was apparent. All participants provided written informed consent.

Procedure

Patients seen consecutively (within scheduling constraints) at the UCLA Hematology/Oncology clinic were selected for screening and recruitment. Participants provided written informed consent and completed questionnaires at study entry as well as at 6- and 12-week follow-up. In order to prevent burden, participants were asked to complete questionnaire assessments contemporaneously with regularly scheduled medical appointments and were allowed to complete the questionnaires at the clinic or at home. Additionally, participants were provided with a pre-addressed envelope to return their completed questionnaires or with a digital

link to complete the questionnaires via the Internet, based on the preference of the patient (note: there were no significant differences in study outcomes by location or method of survey completion). At the 6-week follow-up assessment, participants wore an actigraph continuously for sleep monitoring over 7 days. It is recommended that a period of 4-7 days be used to obtain reliable estimates of actigraphy sleep parameters in lung cancer patients (Grutsch, Wood, et al., 2011). During these seven days, participants also completed a daily diary of sleep behavior and daily activities (i.e., meals, exercise, naps, social contact). All procedures were approved by the Institutional Review Board at the University of California, Los Angeles.

Measures

Medical and demographic information. Medical data (e.g., months since diagnosis, treatment history) and demographic information (e.g., age, sex, race/ethnicity, education) were assessed through self-report and medical chart review, with informed consent.

Internalized stigma. Internalized stigma was measured with an adapted version of the Cancer Responsibility and Regret Scale (CRRS). This scale has characterized regret and personal responsibility in a sample of more than 200 lung cancer patients (Criswell et al., 2016). Specifically, we used the four items from the regret subscale (e.g., "When it comes to my cancer, I have nothing to be ashamed of [reverse scored]") in addition to four new items adapted from HIV-related stigma scales (Berger, Ferrans, & Lashley, 2001; Kalichman et al., 2009), capturing feelings of shame, guilt, and self-blame (e.g., "I feel guilty that I have lung cancer"). The new items were agreed upon for inclusion via consensus of two members of the study team (one of which is an author of the CRRS). A total score was used for analysis by computing a mean of the eight items. The Cronbach alpha reliability coefficient for the total score was adequate ($\alpha = .76$).

Perceived subtle discrimination. The present study used a 50-item author-constructed measure to assess perceived experiences of subtle discrimination that occur in social interactions and are attributed to one's lung cancer status (e.g., "Because of your lung cancer, how often do you experience any situations in which your friends are unfriendly or unwelcoming toward you?"). Participants were asked to respond to ten items that convey social situations in each of five social settings, including their friends, partner (if applicable), family (other than partner), medical team members, and acquaintances/co-workers. The majority of items in the measure were generated using concepts described in existing three measures of stigma and subtle discrimination (Berger et al., 2001; Nadal, 2011; Torres-Harding, Andrade, & Romero Diaz, 2012). Qualitative data suggest that lung cancer stigma is experienced across social contexts (Hamann et al., 2014), and the current measure aimed to capture the range of social contexts through which patients may experience subtle discrimination. A mean score averaging across all social domains was used ($\alpha = .95$).

Subjective sleep behavior. Self-reported sleep behaviors were measured at each assessment using the 21-item Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Participants rated their sleep quality and disturbance over the past 30 days. Component scores from seven domains (i.e., daytime dysfunction, use of sleeping medication, and sleep quality, latency, duration, efficiency, and disturbances) were used to estimate a global score of sleep impairment. A global score of 5 or above on the PSQI is indicative of clinically significant sleep disturbance. A more conservative cutoff score of 8 has been suggested for use in cancer patient samples (Carpenter & Andrykowski, 1998), and both cutoff scores were used to characterize sleep disturbance in the current sample. This scale has demonstrated good validity and internal consistency reliability coefficients above .83 and has

been used to assess sleep quality in lung cancer patients (Le Guen et al., 2007; Vena et al., 2006). A three-subscale scoring system (i.e., perceived sleep quality, sleep efficiency, and daily disturbance) for the PSQI has demonstrated superior psychometric properties to the initial seven-subscale system (Cole et al., 2006) and has been used in past research to assess subjective sleep disruption (e.g., Maglione et al., 2014; Martin, Fiorentino, Joudjian, Josephson, & Alessi, 2010). As such, the global sleep impairment score as well as the three aforementioned subscales were used for mediation analyses.

Objective sleep behavior. Participants wore actigraphs (as wrist motion logger with a light sensor) for seven days at the second assessment point to assess circadian function and completed a daily diary, which included daily assessments of sleep and wake times. Wrist actigraphy is used to measure sleep by recording electronic signals when motion is detected. Actigraphy has been validated for measuring circadian rhythm in cancer patients (Dedert et al., 2012; Levin et al., 2005; Sephton et al., 2013). The second assessment was chosen for actigraphy measurement so that objectively measured sleep characteristics could be analyzed temporally as mediators between the stigma-related predictors at study entry and the outcomes at the 12-week follow-up assessment. Given that actigraphy variables (i.e., sleep efficiency, sleep duration, daytime inactivity, minutes awake after sleep onset [WASO]) and PSQI sleep scores are not strongly related (e.g., Grandner, Kripke, Yoon, & Youngstedt, 2006), all actigraphy variables were analyzed as mediators in addition to the PSQI scores. Sleep efficiency was calculated as the percent of time asleep during rest intervals, sleep duration was calculated as the number of hours asleep during rest intervals, and daytime inactivity was calculated as the percent of time asleep during wake intervals (Ancoli-Israel et al., 2015; Grutsch et al., 2011).

Sleep onset and offset times were scored using the interval windows provided by participants in the sleep diary. All actigraphy data were manually scored by the principal investigator and a second researcher, who were trained in an established actigraphy scoring protocol (Ancoli-Israel et al., 2015). The principal investigator scored all actigraphy data independently and the second researcher reviewed all scoring decisions. Disagreements in scoring decisions between the two researchers were resolved via consensus.

Dependent variables. The outcome variables were measured at study entry, 6-week, and 12-week follow-up. Outcomes included global and cancer-related measures of adjustment across psychological and physical health.

Depressive symptoms. The 20-item Center for Epidemiologic Studies-Depression scale (Radloff, 1977) measured depressive symptoms with internal consistency reliability ranging from .84 to .90 (Radloff, 1977). It has been used in studies assessing depressive symptoms in cancer patients generally (Hann, Winter, & Jacobsen, 1999; Stanton et al., 2005) and in lung cancer patients specifically (Gonzalez & Jacobsen, 2012). For analyses, the item about sleep (i.e., "My sleep was restless") was removed from the total score. Current internal consistency reliability was adequate (all $\alpha > .84$).

Global quality of life. The 27-item Functional Assessment of Cancer Therapy-General scale was used to measure quality of life across physical, emotional, social, and functional well-being domains (Cella, Tulsky, & Gray, 1993). It has established reliability with a coefficient alpha of .68. It has been used in lung patients to measure quality of life (Hollen & Gralla, 1996; Kurita, Garon, Stanton, & Meyerowitz, 2013). A global quality of life score as well as a subscale score for each of the individual domains can be analyzed reliably (Cella et al., 1993). For analytic purposes, items that are conceptually related to sleep behavior (i.e., "I have a lack of

energy", "I am forced to spend time in bed", "I am sleeping well") were removed from the total and subscale scores. The global score was used as the primary outcome (all $\alpha > .93$).

Cancer-specific quality of life. The 9-item Functional Assessment of Cancer Therapy-Lung Cancer subscale was used to measure symptoms and concerns specific to lung cancer patients (Cella et al., 1995). This scale demonstrates excellent internal consistency reliability with a coefficient alpha of .68 (Cella et al., 1995), and it has been used to measure lung cancer-specific symptoms and concerns in patients (e.g., Bezjak et al., 2006; Bonomi et al., 2000). Current internal consistency reliability was adequate (all $\alpha > .69$).

Cancer-related anxiety. Cancer-specific anxiety was assessed using the 20-item Post-Traumatic Stress Disorder Checklist for DSM-5 (Blevins, Weathers, Davis, Witte, & Domino, 2015), which shows excellent internal consistency reliability and validity. This measure has been validated in cancer patients to measure cancer-specific anxiety (DuHamel et al., 2004), and items were keyed specifically to the lung cancer experience. Participants responded on a Likert scale about how bothered they were by a series of problems (e.g., "Thinking specifically of your lung cancer, how much were you bothered by avoiding memories, thoughts, or feelings related to the stressful experience in the last 30 days?"). Items associated with sleep behavior (i.e., "Repeated, disturbing dreams of the stressful experience", "Trouble falling or staying asleep") were removed from the total score to avoid confounding with the mediator variables. For the present study, a total score was used for analyses (all $\alpha > .89$).

Physical symptom bother. The 12-item short form of the Memorial Symptom Assessment-Physical Symptom subscale, which measures common physical symptoms reported by patients (Portenoy et al., 1994), was used to determine frequency of and the degree of bother from physical symptoms. Participants respond on a 5-point Likert scale, and higher scores

indicate more symptom bother. This scale has good internal consistency reliability and validity. The scale has been used in cancer patient samples generally (Tranmer et al., 2003) and lung cancer specifically (Sanders, Bantum, Owen, Thornton, & Stanton, 2010). A mean score of physical symptom bother was used for analyses (all $\alpha > .76$)., and items that overlap with sleep behavior (i.e., "Lack of energy", "Feeling drowsy") were removed.

Analytic Plan

Descriptive statistics were computed for all continuous and categorical predictors. Descriptive statistics for the outcomes were reported with all items included for cautious comparison with norms and reported averages from other samples. Outcomes with sleep-related items excluded were used for all analyses so that the health-related adjustment variables were not confounded with sleep disturbance. Pearson's correlations were computed to assess the relationships between the predictors, mediators, and the dependent variables to characterize zero-order relationships. Age, sex, race/ethnicity, and smoking status were selected as a priori covariates. In accordance with published methodology (e.g., Rini et al., 2014), we decided a priori that any other patient or medical characteristic that was related to the outcome at $p < .05$ would be added as a covariate.

Mediation analyses. In the study of mediators, action theory informs our understanding of how the predictor relates to the mediating variable (i.e., a path; H. Chen, 1990), and conceptual theory is used to describe how the mediator affects the outcome (i.e., b path; MacKinnon, 2008). Even in the absence of a total effect (i.e., c path), mediation analyses are important for their contributions to action and conceptual theory. Research indicates that indirect effects can exist in the absence of a significant direct effect (i.e., c' path) or a nonsignificant total effect (MacKinnon, Krull, & Lockwood, 2000; Preacher & Hayes, 2008; Shrout & Bolger,

2002). Therefore, mediation analyses were conducted whether or not internalized stigma and perceived discrimination were significantly related to the outcomes.

Mediation analyses that use separate hierarchical regression models to test causal steps have been demonstrated to have lower statistical power and inflated Type I error rates, as compared to mediation approaches that use product of coefficients tests (i.e., multiplying the a path and b path coefficients and dividing by the standard error of the product; Fritz & MacKinnon, 2007; MacKinnon et al., 2002). As such, mediation was tested using the latter method with the SEM command in STATA v13 (Stata Corp., LLC). Bootstrap estimates using 5,000 repetitions were used to calculate 95% confidence intervals for all indirect effects, and indirect effects were determined to be statistically significant if the confidence interval did not include zero (Fritz & MacKinnon, 2007). Researchers recommend computing bootstrap estimates of mediation when the expected effect size is small-to-moderate (Shrout & Bolger, 2002), and previous research has used this approach with small samples (Aldred, Green, Emsley, & McConachie, 2012; Killgore, Sonis, Rosso, & Rauch, 2016; Williamson et al., 2017). Indirect effects were determined to be statistically significant if the bootstrap confidence interval did not include zero. Models were estimated with full information maximum likelihood to address missing data (Enders & Bandalos, 2001). Two-tailed significance tests were used for all analyses, and $p < .05$ was considered statistically significant.

Hypothesis 1a. Higher sleep disturbance will be associated significantly with poorer psychological (i.e., depressive symptoms, anxiety symptoms, global quality of life) and physical health outcomes (i.e., cancer-specific quality of life, bothersome physical symptoms). Pearson's product-moment correlations were conducted between sleep characteristics (global subjective sleep disturbance, perceived sleep quality, sleep efficiency, daily disturbance and objective sleep

duration, sleep efficiency, daytime dysfunction, and WASO) and health outcomes (depressive symptoms, global quality of life, cancer-related anxiety, cancer-specific quality of life, physical symptom burden) to investigate whether sleep disturbance was associated significantly with indicators of health-related adjustment.

Hypothesis 1b. Higher internalized stigma and perceived subtle discrimination will be associated significantly with more sleep disturbance (i.e., self-reported sleep impairment, objective sleep characteristics) at study entry and across 12 weeks, controlling for sociodemographic and medical characteristics. Multivariable regression analyses were conducted to investigate whether internalized stigma and perceived subtle discrimination were associated significantly with subjective and objective sleep disturbance at study entry and across time, controlling for pertinent sociodemographic and medical characteristics. The outcome variables (PSQI global sleep score and subscale scores at study entry, objective sleep characteristics) were each entered as the dependent variable in separate analyses. To evaluate change over time in perceived sleep disturbance, the study entry PSQI score at was entered as a covariate and the 6-week and 12-week follow-up values, respectively, were entered as dependent variables in separate analyses (e.g., Martin et al., 2010). A singular assessment of objective sleep behavior at the 6-week follow-up assessment precluded the ability to predict changes across time.

Hypothesis 2. Subjective sleep disturbance will significantly mediate the relationships between internalized stigma and perceived subtle discrimination, and health-related outcomes at study entry and across 12 weeks. To test this hypothesis, mediation analyses were conducted. Internalized stigma and perceived subtle discrimination at study entry were entered as the independent variables for all analyses. To assess cross-sectional relationships, study entry the PSQI global sleep impairment score were entered as the mediator variable and the outcomes

(depressive symptoms, global quality of life, cancer-related anxiety, cancer-specific quality of life, physical symptom burden) at study entry were entered as dependent variables in separate analyses. Next, the three PSQI subscales (i.e., sleep efficiency, perceived sleep quality, daily disturbance) were tested as simultaneous mediators in place of the global sleep disturbance score. Finally, to assess temporal relationships, PSQI sleep impairment scores at 6-week follow-up were entered as mediators and the 12-week follow-up value of each outcome variable was entered as the dependent variable in separate analyses, controlling for the study entry score of the dependent variable.

Hypothesis 3. Objective sleep disturbance measured through actigraphy will mediate the relationships between internalized stigma, perceived subtle discrimination, and psychological and physical health outcomes cross-sectionally and across time. To investigate whether objective sleep disturbance mediated the effect of internalized stigma on health-related adjustment, the same analytic approach was used. Internalized stigma and perceived subtle discrimination at study entry were entered as the independent variable for all analyses. Objective sleep parameters (i.e., sleep duration, sleep efficiency, daytime inactivity, WASO) were entered as simultaneous mediators for all analyses. To assess cross-sectional relationships, the 6-week follow-up score for the outcome was entered as the dependent variable. Next, to assess temporal relationships, the 12-week follow-up value of each outcome variable was entered as the dependent variable in separate analyses.

Results

Sample Characteristics

Of 211 patients screened, 25 were ineligible, 40 declined to participate, and 20 passively refused (e.g., indicated interest in being re-approached but attempts to do so were unsuccessful).

Of 186 eligible patients, 126 (68%) provided informed consent and the 101 (54%) participants (53 men, 48 women) who completed the first survey were included in subsequent analyses. Of the 101 participants, 80 (79%) and 69 (68%) participants completed the 6- and 12-week follow-up assessments, respectively. There was no evidence of differential participant attrition by sociodemographic, medical, or psychosocial characteristics. Specifically, participants who completed all assessments did not differ significantly from participants who completed one or two assessments on any variable included in subsequent analyses.

As shown in Table 1, on average, participants were 64.5 years old, and had 15.7 years of education. The majority was married/living as married, non-Hispanic White, had stage IV disease, and were currently participating in an oncologic clinical trial. The sample was comprised of 90 participants who were diagnosed with non-small cell lung cancer, eight with small cell lung cancer, and three with mesothelioma. Eight participants currently smoked, 56 formerly smoked, and 37 never smoked. Forty-nine participants were receiving immunotherapy, 24 were receiving chemotherapy, 8 were receiving targeted therapy, and 20 were receiving treatment that combined two or more of these therapeutic agents (with n = 19 out of 20 including at least one chemotherapy agent). Too few participants received targeted therapy to analyze as a separate group. As such, participants who were receiving immunotherapy or targeted therapy were combined into one group in subsequent analyses. Immunotherapy and targeted treatment groups did not differ significantly on any variable included in subsequent analyses.

Of the 80 participants who competed the 6-week follow-up survey, 64 were asked to wear the actigraph and complete the sleep diary (note: 16 participants who completed the 6-week follow-up survey were unable to be contacted about wearing the actigraph, despite attempts to do so). A total of 38 participants agreed to wear the actigraph, and 30 actigraphy files were usable

for analysis (2 actigraphs were never returned, 5 yielded device errors when attempting to download the data, and 1 file was judged unable to be scored due to aberrant actigraphy data coupled with a lack of corresponding sleep diary information). Participants who wore actigraphs reported significantly lower symptom bother at the 6-week assessment ($t(77) = 2.02$, $p = .047$) and a significantly greater amount of time had elapsed since their diagnosis ($t(78) = -2.49$, $p = .015$), compared to those who declined. There were no other significant differences between groups in patient, medical, or psychosocial variables. Notably, groups did not differ significantly on self-reported sleep disturbance, internalized stigma, or perceived subtle discrimination. There were too few participants with usable objective sleep data to conduct mediation analyses with two independent variables (e.g., internalized stigma, perceived discrimination) across time. As such, Hypothesis 3 of the present study was only tested cross-sectionally at the 6-week follow-up assessment.

Descriptive Statistics

Stigma and discrimination. Overall levels of internalized stigma ($M = 2.42$, $SD = 1.17$) and perceived subtle discrimination ($M = 0.17$, $SD = 0.28$) were low. On average, patients reported slight disagreement with stigma items, although scores spanned the range of the scales with some patients endorsing moderate or strong agreement with stigma items. Overall, 50.5% (n = 50 of 99) of participants did not report any perceived experiences of subtle discrimination, and patients who did report perceived subtle discrimination most often indicated that it occurred rarely. Internalized stigma and perceived subtle discrimination were correlated significantly ($r = .29$, $p = .003$) and did not interact significantly to predict any study outcome. As such, internalized stigma and perceived discrimination were entered as simultaneous predictors in all subsequent analyses.

Health outcomes. Depressive symptoms and cancer-related anxiety were elevated in the current sample, with 31.7% (n = 32 out of 99) and 28.7% (n = 29 out of 98) of participants reported symptoms suggestive of clinical depression and anxiety, respectively. On average, global quality of life (*M* = 78.21, *SD* = 16.39) was comparable to adults with cancer and slightly lower compared to adults without cancer (Brucker, Yost, Cashy, Webster, & Cella, 2005). Notably, however, there was a meaningful difference (i.e., > 2 points; Brucker et al., 2005) in global quality of life between 46.5% (n = 46 out of 99) of participants in the current sample and the general adult population norms (Brucker et al., 2005). Lung cancer symptom scores (*M* = 19.90, *SD* = 5.32) were similar in the current sample to other samples of lung cancer patients (Cella et al., 1995; Langer et al., 2008). On average, physical symptom bother (*M* = 0.76, *SD* = .71) was low, although there was considerable variability with average scores ranging from "no bother" to "quite a bit". All dependent variables were intercorrelated significantly ($|r|$ = .45-.80, all $p < .001$). Dependent variable scores with all sleep-related items removed (e.g., "Trouble falling or staying asleep") were used for all subsequent analyses.

Sleep characteristics. Overall, perceived sleep disturbance, as indicated by the PSQI global sleep impairment score, was elevated in the current sample (*M* = 7.93, *SD* = 4.40) and was similar to average levels observed in other samples of lung cancer patients (Le Guen et al., 2007; Vena et al., 2006). Notably, 75.0% (n = 69 out of 92) of participants reported sleep disturbance at study entry that exceeded the established cutoff score of 5 (Buysse et al., 1988). Using the more conservative cutoff score of 8 (Carpenter & Andrykowski, 1998), 47.8% (n = 44 out of 99) of participants reported significant sleep disturbance. With regard to objective sleep data, the average nightly sleep duration was 7.14 hours (SD = 1.89). Average daytime inactivity (M = 23.06, SD = 17.48), sleep efficiency scores (M = 82.33, SD = 7.92), and WASO (M =

90.76, SD = 46.94) were similar to those observed in other lung cancer samples (Grutsch et al., 2011; Levin et al., 2005). The PSQI global score and subscales scores were not associated significantly with any objective sleep characteristic (all $p > .06$), consistent with research (Grandner et al., 2006). Subjective sleep subscales were significantly intercorrelated ($|r| = .26$-$.93$, all $p < .03$). Objective sleep indicators were also significantly intercorrelated ($|r| = .46$-$.77$, all $p < .02$), except for daytime inactivity and sleep efficiency ($r = .33$, $p = .072$), WASO and duration ($r = -.26$, $p = .173$), and WASO and daytime inactivity ($r = -.17$, $p = .365$).

Associations of Sleep Disturbance with Health-related Adjustment

At study entry, poorer perceived sleep quality, higher daytime disturbance, poorer sleep efficiency, and higher global sleep disruption were associated significantly with higher depressive symptoms, worse global quality of life, poorer cancer-specific quality of life, higher cancer-related anxiety, and greater physical symptom bother ($|r| = .29$-$.60$, all $p < .01$). Longer objective sleep duration was associated significantly with higher depressive symptoms ($r = .47$, $p = .008$) and higher cancer-related anxiety ($r = .37$, $p = .048$). Daytime inactivity was also associated with higher cancer-related anxiety ($r = .40$, $p = .033$). There were no other significant associations between objective sleep indicators and study outcomes (all $p > .06$).

Sleep Disturbance Regressed on Internalized Stigma and Perceived Subtle Discrimination

Covariates. Regarding potential covariates, there were no significant associations between subjective sleep characteristics with age, sex, race/ethnicity, years of education, marital status, smoking status, months since diagnosis, histology, cancer stage, current oncologic treatment, line of current therapy, days since beginning current treatment, participation in an oncologic clinical trial, or history of cancer-related surgery (all $p > .05$). Women ($t(28) = -2.27$, $p = .031$) and participants who never smoked ($t(28) = 2.06$, $p = .048$) evidenced significantly

longer objective sleep duration. There were no other significant relationships between potential covariates and objective sleep outcomes (all $p > .05$). As such, the a priori covariates (i.e., age, sex, race/ethnicity, smoking status) were entered into all subsequent analyses.

Subjective sleep disturbance. Relationships between internalized stigma, perceived subtle discrimination, and subjective sleep disturbance were tested at study entry and across time, adjusting for covariates. All overall models were statistically significant (model $R^2 = .11$-$.52$, all $F > 3.13$, all $p < .04$). Higher perceived subtle discrimination was associated significantly with higher global subjective sleep disturbance (Tables 2-4), poorer sleep efficiency (Tables 5-7), and worse perceived sleep quality (Tables 8-10) at study entry and with worsening sleep across all aforementioned outcomes across 6 and 12 weeks. At study entry, higher perceived subtle discrimination was associated with higher daily disturbance at study entry and higher internalized stigma was associated with increased daily disturbance across 12 weeks (Tables 11-13). Internalized stigma was not associated with any other subjective sleep outcome at study entry or across time (all $p > .08$). Exploratory correlations revealed significant zero-order relationships between internalized stigma and global subjective sleep disturbance ($r = 52$, $p = .004$) and perceived sleep quality ($r = .49$, $p = .006$) but no significant correlations between internalized stigma and sleep efficiency ($r = .35$, $p = .067$) or daily disturbance ($r = .34$, $p = .069$) at study entry.

Higher internalized stigma and perceived subtle discrimination collectively explained 8-20% of the variance in subjective sleep outcomes at study entry, 4-6% of the variance across 6 weeks, and 5-9% of the variance across 12 weeks. Regarding covariates, age, sex, race/ethnicity, and smoking status were not associated significantly with global perceived sleep disturbance at study entry or across time (all $p > .06$). Men, as compared to women, evidenced worsening sleep

efficiency across 12 weeks; however, neither group evidenced a significant within-group change in sleep disturbance (all $p > .16$). Additionally, younger age was associated with decreased perceived sleep quality across 6 weeks. In sum, there were significant associations between stigma indicators and subjective sleep outcomes in 11 of 12 tested models.

Objective sleep disturbance. Relationships between internalized stigma, perceived discrimination, and objective sleep characteristics were tested among the subset of participants (n = 30) who provided objective sleep data. The overall model was statistically significant for objective sleep duration (model $R^2 = .47$, $F(6, 24) = 3.58$, $p < .001$) but not for sleep efficiency (model $R^2 = .19$, $F(6, 24) = 0.96$, $p = .473$), daytime inactivity (model $R^2 = .30$, $F(6, 24) = 1.73$, $p = .157$), or WASO (model $R^2 = .39$, $F(6, 24) = 2.36$, $p = .066$). Higher internalized stigma was uniquely and significantly associated with longer sleep duration (Table 14) and higher levels of daytime inactivity (Table 15), whereas higher perceived subtle discrimination was associated significantly with shorter sleep duration and lower levels of daytime inactivity. Collectively, internalized stigma and perceived discrimination explained 31% of the variance in objective sleep duration and 26% of the variance in daytime inactivity. Neither internalized stigma nor perceived subtle discrimination were associated significantly with objective sleep efficiency (Table 16) or WASO (Table 17). Regarding covariates, women (vs. men) and never smokers (vs. current/former smokers) evidenced significantly longer objective sleep duration and higher levels of daytime inactivity. In sum, there were significant associations between stigma indicators and objective sleep outcomes in two of four tested models.

Sleep Disturbance as a Mediator between Internalized Stigma and Perceived Discrimination with Health-Related Adjustment

Subjective sleep disturbance. Internalized stigma and perceived discrimination were entered as simultaneous predictors and global subjective sleep disturbance was evaluated a mediator, controlling for a priori covariates. First, cross-sectional relationships were examined at study entry. In all mediation models, higher perceived subtle discrimination (but not internalized stigma) was significantly associated with greater global subjective sleep disturbance (all $p = .001$). Additionally, greater sleep disturbance at study entry was associated with higher depressive symptoms, poorer global quality of life, worse cancer-specific quality of life, higher cancer-related anxiety, and higher physical symptom bother (all $p < .001$), beyond sociodemographic, medical, and smoking-related factors.

Higher global subjective sleep disturbance significantly mediated the relationship between higher perceived discrimination higher depressive symptoms (indirect effect = 5.11, $p = .005$, 95% CI [1.51, 8.70]), poorer global quality of life (indirect effect = -9.49, $p = .003$, 95% CI [-15.71, -3.27]), worse cancer-specific quality of life (indirect effect = -12.51, $p = .003$, 95% CI [-20.63, -4.38]), higher cancer-related anxiety (indirect effect = 3.63, $p = .012$, 95% CI [0.81, 6.44]), and higher physical symptom bother (indirect effect = 0.40, $p = .004$, 95% CI [0.13, 0.67]). These results are displayed in Table 18. Global subjective sleep disturbance did not significantly mediate relationships between internalized stigma and health outcomes at study entry, although higher internalized stigma was significantly associated with higher depressive symptoms, poorer global quality of life, worse cancer-specific quality of life, and higher cancer-related anxiety (all $p < .03$), beyond covariates and global subjective sleep disturbance.

When the three PSQI subscales were tested as simultaneous mediators, daily disturbance (but not sleep efficiency [all $p > .17$] or perceived sleep quality [all $p > .31$]) significantly mediated the association between perceived subtle discrimination and higher depressive

symptoms (indirect effect = 6.27, p = .009 95% CI [1.92, 18.05]), poorer global quality of life (indirect effect = -12.56, p = .003, 95% CI [-28.63, -5.40]), worse cancer-specific quality of life (indirect effect = -14.85, p = .004 95% CI [-30.70, -6,11]), higher cancer-related anxiety (indirect effect = 4.48, p = .039, 95% CI [0.54, 10.69]), and higher physical symptom bother (indirect effect = 0.52, p = .006, 95% CI [0.21, 1.05]), beyond sociodemographic, medical, and smoking-related characteristics. Ten of the 10 tested mediation models at study entry yielded significant indirect effects.

Next, temporal relationships were examined. Subjective sleep disturbance at 6-week follow-up did not significantly mediate any relationship between study entry internalized stigma, perceived subtle discrimination, health outcomes at 12-week follow-up, controlling for the study entry value of the outcome variable (all $p > .28$). These findings are displayed in Table 19. In four out of five mediation models, higher perceived discrimination was associated with higher global sleep disturbance at 6-week follow-up (all $p < .04$). Higher global sleep disturbance at 6-week follow-up was not associated significantly with change in any health-related outcome across 12 weeks (all $p > .23$). Higher internalized stigma (but not perceived discrimination) at study entry was associated significantly with increased depressive symptoms, worsening global quality of life, worsening cancer-specific quality of life, and increased cancer-related anxiety (all $p < .03$) across 12 weeks, beyond covariates and subjective sleep disturbance at 6-week follow-up. When the three PSQI subscales were tested as simultaneous mediators, neither daily disturbance, sleep efficiency, nor perceived sleep quality significantly mediated associations between stigma indicators and changes in health outcomes across 12 weeks (all $p > .21$). None of the 10 tested longitudinal mediation models yielded significant indirect effects.

Objective sleep disturbance. Among the subsample of participants who wore actigraphs (n = 30), mediation analyses were conducted to investigate if objective sleep duration, sleep efficiency, and daytime inactivity mediated relationships between internalized stigma, perceived discrimination, and psychological and physical health outcomes at 6-week follow-up. Internalized stigma and perceived discrimination were entered as simultaneous predictors and objective sleep impairment indicators were entered as simultaneous mediators, controlling for a priori covariates. In all analyses, internalized stigma and perceived discrimination were not significantly associated with the four indicators of objective sleep disturbance (all $p > .12$), and no indicator of objective sleep disturbance was associated significantly with any health outcome at 6-week follow-up (all $p > .21$). Furthermore, there was no evidence that objective indicators of sleep disturbance collectively mediated relationships between internalized stigma and perceived discrimination on health outcomes (all $p > .17$). None of the five mediation models yielded significant indirect effects. However, these results should be interpreted with caution, given the small sample size.

Discussion

In this 12-week study of 101 men and women in treatment for lung cancer, we investigated relationships between internalized lung cancer stigma, perceived subtle discrimination, subjective and objective (measured through actigraphy) sleep disturbance, and psychological and physical health outcomes. Overall, findings revealed that perceived subtle discrimination (but not internalized stigma) was associated significantly with subjective (but not objective) sleep disturbance. Additionally, subjective sleep disturbance was associated with poorer psychological and physical health outcomes in cross-sectional but not longitudinal analyses. Furthermore, global subjective sleep disturbance significantly mediated relationships

between higher perceived subtle discrimination and higher depressive symptoms, worse global quality of life, poorer cancer-specific quality of life, higher cancer-related anxiety, and higher physical symptom bother at study entry. Furthermore, subjective daily disturbance (but not sleep efficiency or perceived sleep quality) uniquely and significantly explained the relationship between higher perceived subtle discrimination and worse health-related outcomes.

A substantial proportion of participants reported significant levels of global sleep disturbance, which is consistent with research (Grutsch et al., 2011; Levin et al., 2005) and emphasizes that sleep disturbance is frequent and bothersome for lung cancer patients (Gooneratne et al., 2007; Le Guen et al., 2007; Vena et al., 2006). There were no differences in subjective sleep characteristics by sociodemographic, medical, or smoking-related factors. As hypothesized, poorer perceived sleep quality and efficiency, greater daytime disturbance, and greater global sleep disturbance were cross-sectionally associated with poorer psychological and physical health outcomes, consistent with research (Cho et al., 2008; Chrousos, 2009; Mohr et al., 2003; Moore, Adler, Williams, & Jackson, 2002; Reilly-Spong, Park, & Gross, 2013).

With regard to objective sleep, longer sleep duration and higher daytime inactivity were associated with higher cancer-related anxiety, and longer sleep duration was also associated with higher depressive symptoms. Women (vs. men) and participants who never smoked (vs. participants who current or formerly smoked) evidenced significantly longer sleep duration. However, these differences were no longer significant after removing one influential outlier from the analysis. Overall, subjective sleep characteristics were more consistently related to poorer health outcomes than objective sleep disturbance, which is consistent with some research in adults without cancer (Bei, Milgrom, Ericksen, & Trinder, 2010; Vollkovich, Tikotzky, & Manber, 2016). However, other studies demonstrate that both subjective and objective indicators

of sleep disturbance are robustly related to health-related adjustment (e.g., Martin et al., 2010). The fewer number participants in the analyses with objective sleep indicators may explain this pattern of results in the current sample.

Next, we demonstrated that higher perceived subtle discrimination was uniquely and significantly associated with several indicators of higher subjective sleep disturbance at study entry and with significant increases in sleep disturbance across 6 and 12 weeks, beyond sociodemographic, medical, and smoking-related factors. This is the first study to test relationships between indicators of lung cancer stigma and sleep outcomes. Findings demonstrate that perceived lung cancer-related discrimination is not only related to poorer psychological and physical health outcomes (e.g., Criswell et al., 2016) but also to sleep disturbance, which is a behavioral health outcome. These results are consistent with the broader literature that perceived discrimination is associated with poor sleep (Beatty et al., 2011; Elovainio et al., 2009; Elovainio et al., 2003; 2003; Fuller-Rowell et al., 2016; Huynh, 2012; Lewis et al., 2013; Slopen & Williams, 2014). No study has investigated whether internalized stigma was related to sleep outcomes in any population. Our findings indicate that there is no significant unique association between internalized lung cancer stigma and indicators of subjective sleep disturbance, suggesting that sleep may be affected more by perceived discrimination than by internalized stigma. However, there were significant zero-order relationships between higher internalized stigma and worse perceived sleep quality and higher global sleep disturbance. These results suggest that internalized stigma may be associated more strongly with the aspects of sleep disturbance that involve subjective appraisal (e.g., poor sleep quality) but not to others (e.g., sleep duration, efficiency).

With regard to objective sleep disturbance, internalized stigma and perceived discrimination were each related to sleep duration and daytime inactivity but in opposite directions. Higher perceived discrimination was significantly related to shorter sleep duration, which is consistent with research (Beatty et al., 2011; Lewis et al., 2013). Higher perceived discrimination was also related to lower levels of daytime inactivity, which is inconsistent with one study demonstrating that discrimination is related to daytime fatigue (Beatty et al., 2011). By contrast, higher internalized stigma was associated significantly with longer sleep duration and higher levels of daytime activity. It is unclear why this pattern of findings emerged. One possibility is that depressive symptoms is contributing simultaneously to higher internalized stigma, hypersomnia at night, and lethargy during the day.

We hypothesized that subjective and objective measures of sleep disturbance would mediate relationships between internalized lung cancer stigma, perceived subtle discrimination, and psychological and physical health outcomes. Subjective (but not objective) sleep disturbance significantly mediated relationships between higher perceived subtle discrimination and higher depressive symptoms, worse global quality of life, poorer cancer-specific quality of life, higher cancer-related anxiety, and higher physical symptom bother at study entry. Furthermore, daily disturbance was the only subjective sleep characteristic that uniquely and significantly explained relationships between perceived discrimination and poorer health-related outcomes, over and above sleep efficiency, perceived sleep quality, and other covariates. These findings demonstrate that global sleep disturbance broadly and daily disturbance specifically can mediate relationships between discrimination and physical health-related outcomes, which is a novel finding. Other studies have demonstrated that sleep quality mediated relationships between perceived discrimination and self-rated global health (D. Chen & Yang, 2014) and depressive symptoms

(Steffen & Bowden, 2006) in adults without cancer. However, these studies did not control for other subjective sleep characteristics such as daily disturbance or sleep efficiency. Sleep disturbance may be a pathway through which perceptions of lung cancer-related discrimination are associated with worse general and cancer-specific health-related outcomes across psychological and physical domains. Future studies should test whether experiences of perceived subtle discrimination prompt cognitive-affective processes such as rumination or pre-sleep worry (Åkerstedt, 2006; Thomsen, Mehlsen, Christensen, & Zachariae, 2003), which may in turn prevent restful sleep for lung cancer patients.

In all cross-sectional mediation analyses, subjective global sleep disturbance was associated significantly with all indicators of psychological and physical health outcomes, beyond sociodemographic, medical, and smoking-related factors. Higher subjective sleep disturbance at 6-week follow-up was not associated with changes in any health-related outcome across 12 weeks, however. The lack of relationship between subjective sleep disturbance and changes in study outcomes across 12 weeks may explain why sleep disturbance did not significantly mediate relationships between perceived discrimination and health-related outcomes across time. Additionally, higher internalized stigma at study entry was associated significantly with increased depressive symptoms, worsening global-quality of life, worsening cancer-specific quality of life, and increased cancer-related anxiety across 12 weeks, over and above sleep disturbance and covariates. These results bolster the understanding that internalized stigma can be deleterious for psychological and physical health-related outcomes, independent from what can be explained by sleep disturbance, a robust predictor of poor health. Future studies should test other proposed mechanisms such as perceived stress or emotion dysregulation (e.g., Hatzenbuehler et al., 2009; McLaughlin, Hatzenbuehler, & Hilt, 2009) as mediators

between internalized stigma and perceived discrimination on health-related outcomes across time.

Objective sleep indicators did not significantly mediate relationships between internalized stigma and perceived discrimination on psychological and physical health outcomes. However, these findings should be interpreted with caution due to the small sample size used for analyses. Interestingly, participants who wore actigraphs (vs. those who declined) reported significantly lower physical symptom bother and a greater amount of time had elapsed since their lung cancer diagnosis. These findings may suggest that although actigraphy is noninvasive, the associated time commitment (e.g., completing the daily sleep diary, mailing back the actigraph) may be burdensome for patients who report bothersome physical symptoms or who were recently diagnosed.

Limitations and Strengths

A strength of this study is its measurement of both subjective and objective indicators of sleep disturbance. However, current findings with objective sleep outcomes should be cautiously interpreted, given that a small subsample of participants had usable objective sleep data. Research in larger samples is needed to test whether objective indicators of sleep disturbance are related to lung cancer stigma and discrimination, and future studies may utilize strategies to control for false discovery rates (Benjamini, Krieger, & Yekutieli, 2006). Additionally, causality cannot be directly inferred by nature of the present study's correlational design. Interventions that aim to target lung cancer stigma and its associated experiences, improve sleep quality as an intermediary outcome, and test changes in health-related outcomes over time would further strengthen causal inference. Future studies might incorporate actigraphy assessment at study entry rather than at a follow-up assessment to avoid issues of participant attrition when recruiting

participants to wear actigraphs. Another strength of the study is the measurement of both psychological and physical health outcomes, which furthers the understanding that sleep disturbance in lung cancer patients can be deleterious for a range of health outcomes. Research on stigma and discrimination have traditionally been studied in separate research disciplines (Stuber, Meyer, & Link, 2008), and this study is novel in that it assesses unique relationships between internalized stigma, perceived discrimination, and sleep. Most participants were non-Hispanic white and caution is warranted in generalizing these findings broadly. However, race/ethnicity was not associated with internalized stigma, perceived subtle discrimination, sleep, or health outcomes.

Conclusions

This longitudinal investigation demonstrated that perceived subtle discrimination about one's lung cancer (but not internalized stigma) is robustly associated with higher subjective sleep disturbance. Furthermore, sleep disturbance was cross-sectionally associated with poorer outcomes across all indicators of psychological and physical health. Subjective global sleep disturbance broadly and daily disturbances specifically mediated relationships between higher perceived discrimination and higher depressive symptoms, worse global quality of life, poorer cancer-specific quality of life, higher cancer-related anxiety, and higher physical symptom bother at study entry. These findings illuminate sleep disturbance as a pathway through which perceived subtle discrimination may hinder health-related adjustment for lung cancer patients. There was no evidence in the current study that sleep outcomes mediate the relationship between higher internalized stigma and poorer psychological and physical health. As such, future research is needed to test other putative mechanisms such as rumination. Behavioral interventions for lung cancer patients are needed to address sleep disturbance such as Cognitive Behavioral Therapy for

Insomnia (Edinger, Wohlgemuth, Radtke, Marsh, & Wuillian, 2001) or Tai Chi (Irwin et al., 2014). Researchers should evaluate whether potential improvements in sleep have downstream effects on quality of life and health. Such an investigation would bolster causal inference of the effects of poor sleep on health-related outcomes in lung cancer patients and may guide the development of behavioral interventions that aim to improve the health and well-being for lung cancer patients.

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Table 1

Sample characteristics and demographics (N = 101)

	n	Mean	Standard Deviation
Age (in years)	101	64.54	11.60
Years of Education	93	15.69	2.83
Internalized Stigma	98	2.42	1.17
Perceived subtle discrimination	99	0.17	0.29
CES-D depressive symptoms at study entry	99	17.57	4.02
FACT-G Global quality of life at study entry	99	57.15	16.80
FACT-L Lung-cancer specific quality of life at study entry	99	19.90	5.32
PCL Cancer-related anxiety at study entry	98	29.72	9.68
MSAS Physical symptom bother at study entry	101	0.76	0.71
PSQI Global sleep disturbance at study entry	92	7.44	4.61
PSQI Perceived sleep quality at study entry	92	3.63	2.31
PSQI Sleep efficiency at study entry	92	1.72	1.88
PSQI Daytime disturbance at study entry	87	2.67	1.20
Objective sleep duration (in hours) at 6-week follow-up	30	7.15	1.89
Objective sleep efficiency (percent of time asleep during rest intervals) at 6-week follow-up	30	82.33	7.92
Objective daytime inactivity (percent of time asleep during wake intervals) at 6-week follow-up	30	23.06	17.48
Objectively assessed minutes awake after sleep onset	30	90.76	46.94
	n	Median	Interquartile Range
Months since lung cancer diagnosis	101	9.97	17.38
Days since beginning current treatment	100	29.00	168.25
	n	%	
Sex			
Male	53	52.5	
Female	48	47.5	
Race/Ethnicity			
Non-Hispanic white	72	71.3	
Other race/ethnicity	29	28.7	
Marital status			
Married/Living as married	66	65.3	
Not married	34	33.7	
Did not report	1	1.0	
Yearly family income			
>$100,000	52	51.5	
$65,000-$99,999	18	17.8	
<$65,000	28	27.7	
Did not report	3	3.0	

Smoking status			
	Current	8	7.9
	Former	56	55.4
	Never	37	36.6
Cancer type			
	Non-small cell lung cancer	90	89.1
	Other lung cancer type	11	10.9
Stage of disease			
	Stage I or II	7	7.0
	Stage III	18	17.8
	Stage IV	74	73.3
	Missing	2	2.0
Current participation in oncologic clinical trial			
	Yes	55	54.4
	No	45	44.6
	Missing	1	1.0
Current oncologic treatment			
	Immunotherapy only	49	48.5
	Chemotherapy only	24	23.8
	Targeted therapy only	8	7.9
	Combination therapy	20	19.8
Line of current oncologic treatment			
	First	48	47.4
	Second	22	21.8
	Third	16	15.8
	Fourth or fifth	14	14.9
	Missing	1	1.0
History of lung cancer-related surgery			
	Yes	29	28.7
	No	71	70.3
	Missing	1	1.0
Past receipt of chemotherapy for lung cancer			
	Yes	48	47.5
	No	52	51.5
	Missing	1	1.0

Note: CES-D = Center for Epidemiologic Studies-Depression scale. FACT-G = Functional Assessment of Cancer Therapy-General Scale. FACT-L = Functional Assessment of Cancer Therapy-Lung Subscale. PCL = Posttraumatic Stress Disorder Checklist for DSM-5. MSAS = Memorial Symptom Assessment Scale. PSQI = Pittsburgh Sleep Quality Index.

Table 2

Internalized stigma and perceived subtle discrimination as predictors of PSQI global subjective sleep disturbance at study entry

	Global Subjective Sleep Disturbance at Study Entry			
Predictor	*b*	*z*	*p*	95% CI
Intercept	3.57	1.22	.221	[-2.16, 9.30]
Age (in years)	0.04	1.05	.294	[-0.04, 0.12]
Sex (female vs. male)	0.05	0.06	.952	[-1.67, 1.78]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	0.03	0.03	.974	[-1.74, 1.80]
Smoking history (current/former vs. never)	0.62	0.64	.523	[-1.28, 2.52]
Internalized stigma	0.11	0.24	.811	[-0.76, 0.97]
Perceived subtle discrimination	**3.58**	**3.82**	**<.001**	**[3.15, 9.77]**

Note: N = 101. Global subjective sleep disturbance at study entry was entered as the dependent variable. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. PSQI = Pittsburgh Sleep Quality Index. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 3

Internalized stigma and perceived subtle discrimination as predictors of PSQI global subjective sleep disturbance across 6 weeks

	Global Subjective Sleep Disturbance at 6-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**6.58**	**2.84**	**.005**	**[2.04, 11.13]**
Global subjective sleep disturbance at study entry	**0.51**	**5.37**	**<.001**	**[0.32, 0.69]**
Age (in years)	-0.06	-1.81	.070	[-0.12, <-0.01]
Sex (female vs. male)	-0.52	-0.68	.497	[-2.02, 0.98]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-1.00	-1.21	.226	[-2.60, 0.62]
Smoking history (current/former vs. never)	0.71	0.84	.398	[-0.94, 2.36]
Internalized stigma	-0.01	-0.03	.976	[-0.75, 0.73]
Perceived subtle discrimination	**2.96**	**2.02**	**.043**	**[0.09, 5.83]**

Note: N = 101. Global subjective sleep disturbance at 6-week follow-up was entered as the dependent variable. To assess change, the study entry value of subjective sleep disturbance was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. PSQI = Pittsburgh Sleep Quality Index. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 4

Internalized stigma and perceived subtle discrimination as predictors of PSQI global subjective sleep disturbance across 12 weeks

	Global Subjective Sleep Disturbance at 12-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	2.16	0.88	.380	[-2.66, 6.99]
Global subjective sleep disturbance at study entry	**0.66**	**6.10**	**<.001**	**[0.45, 0.87]**
Age (in years)	<-0.01	-0.12	.901	[-0.07, 0.06]
Sex (female vs. male)	-1.43	-1.84	.066	[-2.96, 0.10]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.22	-0.27	.786	[-1.81, 1.37]
Smoking history (current/former vs. never)	1.06	1.26	.207	[-0.59, 2.71]
Internalized stigma	-0.10	-0.27	.791	[-0.81, 0.62]
Perceived subtle discrimination	**4.32**	**2.59**	**.010**	**[1.05, 7.59]**

Note: N = 101. Global subjective sleep disturbance at 12-week follow-up was entered as the dependent variable. To assess change, the study entry value of subjective sleep disturbance was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. PSQI = Pittsburgh Sleep Quality Index. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 5

Internalized stigma and perceived subtle discrimination as predictors of PSQI sleep efficiency at study entry

	PSQI Sleep Efficiency at Study Entry			
Predictor	*b*	*z*	*p*	95% CI
Intercept	0.56	0.44	.663	[-1.96, 3.09]
Age (in years)	0.01	0.61	.544	[-0.02, 0.04]
Sex (female vs. male)	-0.13	-0.35	.729	[-0.90, 0.63]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	0.25	0.62	.532	[-0.53, 1.03]
Smoking history (current/former vs. never)	0.08	0.19	.853	[-0.75, 0.92]
Internalized stigma	0.03	0.14	.886	[-0.35, 0.41]
Perceived subtle discrimination	**2.21**	**2.97**	**.003**	**[0.75, 3.67]**

Note: N = 101. PSQI Sleep efficiency study entry was entered as the dependent variable. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. PSQI = Pittsburgh Sleep Quality Index. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 6

Internalized stigma and perceived subtle discrimination as predictors of PSQI sleep efficiency across 6 weeks

	PSQI Sleep Efficiency at 6-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	1.60	1.40	.161	[-0.06, 3.83]
PSQI Sleep efficiency at study entry	**0.36**	**3.57**	**<.001**	**[0.16, 0.56]**
Age (in years)	-0.01	-0.72	.473	[-0.04, 0.02]
Sex (female vs. male)	-0.42	-1.15	.250	[-1.14, 0.30]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.17	-0.44	.662	[-0.94, 0.60]
Smoking history (current/former vs. never)	0.29	0.71	.480	[-0.51, 1.08]
Internalized stigma	-0.09	-0.48	.629	[-0.44, 0.27]
Perceived subtle discrimination	**1.76**	**2.41**	**.016**	**[0.33, 3.19]**

Note: N = 101. PSQI Sleep efficiency at 6-week follow-up was entered as the dependent variable. To assess change, the study entry value of PSQI Sleep efficiency was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 7

Internalized stigma and perceived subtle discrimination as predictors of PSQI sleep efficiency across 12 weeks

	PSQI Sleep Efficiency at 12-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	0.03	0.02	.981	[-2.25, 2.30]
PSQI Sleep efficiency at study entry	**0.35**	**3.05**	**.002**	**[0.13, 0.05]**
Age (in years)	0.02	1.14	.255	[-0.01, 0.05]
Sex (female vs. male)	**-1.03**	**-2.74**	**.006**	**[-1.77, -0.29]**
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	0.14	0.37	.713	[-0.62, 0.90]
Smoking history (current/former vs. never)	0.38	0.96	.336	[-0.40, 1.17]
Internalized stigma	-0.16	-0.96	.344	[-0.50, 0.17]
Perceived subtle discrimination	**2.20**	**2.88**	**.004**	**[0.70, 3.69]**

Note: N = 101. PSQI Sleep efficiency at 12-week follow-up was entered as the dependent variable. To assess change, the study entry value of PSQI Sleep efficiency was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 8

Internalized stigma and perceived subtle discrimination as predictors of PSQI perceived sleep quality at study entry

	PSQI Perceived Sleep Quality at Study Entry			
Predictor	*b*	*z*	*p*	95% CI
Intercept	1.27	0.80	.425	[-1.85, 4.39]
Age (in years)	0.02	1.07	.286	[-0.02, 0.06]
Sex (female vs. male)	0.30	0.63	.531	[-0.64, 1.24]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.12	-0.24	.807	[-1.09, 0.85]
Smoking history (current/former vs. never)	0.60	1.13	.259	[-0.44, 1.63]
Internalized stigma	0.01	0.04	.967	[-0.46, 0.48]
Perceived subtle discrimination	**2.36**	**2.57**	**.010**	**[0.56, 4.16]**

Note: N = 101. PSQI Perceived sleep quality at study entry was entered as the dependent variable. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. PSQI = Pittsburgh Sleep Quality Index. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 9

Internalized stigma and perceived subtle discrimination as predictors of PSQI perceived sleep quality across 6 weeks

	PSQI Perceived Sleep Quality at 6-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	4.96	4.07	<.001	[2.57, 7.35]
PSQI Perceived sleep quality at study entry	**0.48**	**5.33**	**<.001**	**[0.30, 0.66]**
Age (in years)	**-0.05**	**-2.87**	**.004**	**[-0.08, -0.02]**
Sex (female vs. male)	-0.44	-1.11	.267	[-1.21, 0.34]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.70	-1.66	.097	[-1.53, 0.13]
Smoking history (current/former vs. never)	0.56	1.28	.199	[-0.30, 1.41]
Internalized stigma	-0.15	-0.80	.426	[-0.52, 0.22]
Perceived subtle discrimination	**1.96**	**2.51**	**.012**	**[0.43, 3.50]**

Note: N = 101. PSQI Perceived sleep quality at 6-week follow-up was entered as the dependent variable. To assess change, the study entry value of PSQI Perceived sleep quality was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 10

Internalized stigma and perceived subtle discrimination as predictors of PSQI perceived sleep quality 12 weeks

	PSQI Perceived Sleep Quality at 12-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	2.29	1.73	.073	[-0.21, 4.80]
PSQI Perceived sleep quality at study entry	**0.59**	**6.25**	**<.001**	**[0.42, 0.78]**
Age (in years)	-0.02	-0.98	.328	[-0.05, 0.02]
Sex (female vs. male)	-0.63	-1.52	.129	[-1.45, 0.18]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.12	-0.27	.787	[-0.97, 0.73]
Smoking history (current/former vs. never)	0.60	1.31	.191	[-0.30, 1.49]
Internalized stigma	-0.16	-0.83	.407	[-0.54, 0.22]
Perceived subtle discrimination	**2.90**	**3.39**	**.001**	**[1.22, 4.57]**

Note: N = 101. PSQI Perceived sleep quality at 12-week follow-up was entered as the dependent variable. To assess change, the study entry value of PSQI Perceived sleep quality was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 11

Internalized stigma and perceived subtle discrimination as predictors of PSQI daily disturbance at study entry

	PSQI Daily Disturbance at Study Entry			
Predictor	*b*	*z*	*p*	95% CI
Intercept	1.33	1.69	.092	[-0.22, 2.87]
Age (in years)	0.02	1.63	.102	[<-0.01, 0.33]
Sex (female vs. male)	-0.14	-0.58	.560	[-0.61, 0.33]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.29	-1.21	.226	[-0.76, 0.18]
Smoking history (current/former vs. never)	<0.01	<0.01	.997	[-0.51, 0.51]
Internalized stigma	0.01	0.11	.911	[-0.22, 0.24]
Perceived subtle discrimination	**2.27**	**4.64**	**<.001**	**[1.31, 3.23]**

Note: N = 101. PSQI Daily disturbance at study entry was entered as the dependent variable. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. PSQI = Pittsburgh Sleep Quality Index. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 12

Internalized stigma and perceived subtle discrimination as predictors of PSQI daily disturbance across 6 weeks

	PSQI Daily Disturbance at 6-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**2.00**	**2.48**	**.013**	**[0.42, 3.57]**
PSQI Daily disturbance at study entry	**0.39**	**3.18**	**.001**	**[0.15, 0.63]**
Age (in years)	-0.01	-1.39	.164	[-0.03, 0.01]
Sex (female vs. male)	0.10	0.40	.692	[-0.39, 0.59]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.35	-1.29	.198	[-0.87, 0.18]
Smoking history (current/former vs. never)	-0.15	-0.55	.584	[-0.70, 0.39]
Internalized stigma	0.21	1.74	.082	[-0.03, 0.45]
Perceived subtle discrimination	0.75	1.37	.171	[-0.33, 1.84]

Note: N = 101. PSQI Daily disturbance at 6-week follow-up was entered as the dependent variable. To assess change, the study entry value of PSQI Daily disturbance was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 13

Internalized stigma and perceived subtle discrimination as predictors of PSQI daily disturbance across 12 weeks

	PSQI Daily Disturbance at 12-week Follow-up			
Predictor	*b*	*z*	*p*	95% CI
Intercept	<-0.01	<-0.01	.997	[-1.57, 1.56]
PSQI Daily disturbance at study entry	**0.73**	**5.83**	**<.001**	**[0.49, 0.98]**
Age (in years)	<-0.01	-0.09	.926	[-0.02, 0.02]
Sex (female vs. male)	0.21	0.82	.414	[-0.30, 0.71]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.23	-0.89	.376	[-0.75, 0.28]
Smoking history (current/former vs. never)	0.10	0.36	.718	[-0.44, 0.64]
Internalized stigma	**0.30**	**2.51**	**.012**	**[0.07, 0.54]**
Perceived subtle discrimination	-0.36	-0.59	.554	[-1.57, 1.57]

Note: N = 101. PSQI Daily disturbance at 12-week follow-up was entered as the dependent variable. To assess change, the study entry value of PSQI Daily disturbance was entered as a covariate. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 14

Internalized stigma and perceived subtle discrimination as predictors of objective sleep duration

	Objective Sleep Duration			
Predictor	*b*	*z*	*p*	95% CI
Intercept	4.27	1.63	.104	[-0.87, 9.41]
Age (in years)	0.03	0.88	.380	[-0.04, 0.10]
Sex (female vs. male)	**1.74**	**3.18**	**.001**	**[0.67, 2.82]**
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.34	-0.54	.586	[-1.56, 0.88]
Smoking history (current/former vs. never)	**-2.47**	**-3.70**	**<.001**	**[-3.78, -1.16]**
Internalized stigma	**0.90**	**2.93**	**.003**	**[0.30, 1.50]**
Perceived subtle discrimination	**-2.99**	**-2.54**	**.011**	**[-5.30, -0.68]**

Note: N = 30. Objective sleep duration (i.e., number of hours asleep during rest intervals) was entered as the dependent variable. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 15

Internalized stigma and perceived subtle discrimination as predictors of objective daytime inactivity

	Objective Daytime Inactivity			
Predictor	*b*	*z*	*p*	95% CI
Intercept	-7.03	-0.26	.795	[-60.02, 45.95]
Age (in years)	0.39	1.02	.307	[-0.36, 1.14]
Sex (female vs. male)	**12.02**	**2.08**	**.037**	**[0.72, 23.31]**
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	2.38	0.36	.719	[-10.59, 15.34]
Smoking history (current/former vs. never)	**-19.41**	**-2.80**	**.005**	**[-32.98, -5.83]**
Internalized stigma	**6.65**	**2.04**	**.041**	**[0.27, 13.03]**
Perceived subtle discrimination	**-29.62**	**-2.50**	**.012**	**[-52.85, -6.40]**

Note: N = 30. Objective daytime activity (i.e., percent of time asleep during wake intervals) was entered as the dependent variable. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 16

Internalized stigma and perceived subtle discrimination as predictors of objective sleep efficiency

	Objective Sleep Efficiency			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**90.04**	**6.57**	**<.001**	**[63.17, 116.91]**
Age (in years)	-0.08	-0.41	.682	[-0.45, 0.29]
Sex (female vs. male)	3.09	1.10	.272	[-2.42, 8.59]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	-0.98	-0.30	.762	[-7.34, 5.38]
Smoking history (current/former vs. never)	-4.42	-1.22	.221	[-11.49, 2.65]
Internalized stigma	0.27	0.15	.883	[-3.37, 3.92]
Perceived subtle discrimination	-8.59	-1.37	.170	[-20.96, 3.68]

Note: N = 30. Objective sleep efficiency (i.e., percent of time asleep during rest intervals) was entered as the dependent variable. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 17

Internalized stigma and perceived subtle discrimination as predictors of objective WASO

	Objective WASO			
Predictor	*b*	*z*	*p*	95% CI
Intercept	**1.94**	**0.02**	**.986**	**[-150.54, 153.31]**
Age (in years)	0.88	0.82	.414	[-1.23, 3.00]
Sex (female vs. male)	-1.79	-0.11	.912	[-33.66, 30.08]
Race/ethnicity (other race/ethnicity vs. non-Hispanic white)	6.76	0.36	.720	[-30.15, 43.67]
Smoking history (current/former vs. never)	18.76	0.92	.358	[-21.22, 58.72]
Internalized stigma	4.57	0.43	.666	[-16.16, 25.29]
Perceived subtle discrimination	46.96	1.36	.175	[-20.82, 114.74]

Note: N = 30. Objective WASO (i.e., minutes awake after sleep onset) was entered as the dependent variable. b = unstandardized coefficient estimate. z = z-score test statistic. CI = confidence interval. Bolded statistics indicate regression coefficients significant at $p < .05$.

Table 18

Global subjective sleep disturbance as a mediator of the association between internalized stigma, perceived subtle discrimination, and psychological and physical health outcomes at study entry

Outcome at Study Entry	**Predictor**	***a***	***p***	***b***	***p***	***c***	***p***	***a*b***	***p***	**95% CI**	***c'***	***p***
Depressive Symptoms	Internalized Stigma	0.08	.864	**0.92**	**<.001**	**1.91**	**.028**	0.07	.864	[-0.74, 0.88]	**1.84**	**.018**
	Perceived Discrimination	**5.54**	**.001**			4.93	.125	**5.11**	**.005**	**[1.51, 8.70]**	-0.18	.955
Global Quality of Life	Internalized Stigma	0.11	.797	**-1.71**	**<.001**	**-3.51**	**.008**	-0.19	.798	[-1.68, 1.29]	**-2.90**	**.004**
	Perceived Discrimination	**5.56**	**.001**			**-16.92**	**.001**	**-9.49**	**.003**	[-15.71, -3.27]	-7.43	.103
Cancer-specific Quality of Life	Internalized Stigma	0.11	.810	**-2.28**	**<.001**	**-4.39**	**.009**	-0.24	.810	[-2.21, 1.73]	**-4.15**	**.004**
	Perceived Discrimination	**5.50**	**.001**			**-18.21**	**.004**	**-12.51**	**.003**	[-20.63, -4.38]	-5.71	.313
Cancer-related Anxiety	Internalized Stigma	0.11	.809	**0.63**	**<.001**	**1.61**	**.028**	0.07	.810	[-0.49, 0.63]	**1.54**	**.025**
	Perceived Discrimination	**5.73**	**.001**			**8.37**	**.003**	**3.63**	**.012**	**[0.81, 6.44]**	4.75	.102
Physical Symptom Bother	Internalized Stigma	0.12	.787	**0.07**	**<.001**	0.04	.493	0.01	.788	[-0.05, 0.07]	0.04	.535
	Perceived Discrimination	**5.57**	**.001**			0.47	.051	**0.40**	**.004**	**[0.13, 0.67]**	0.07	.759

Note: N = 101. Subjective sleep disturbance (i.e., Pittsburgh Sleep Quality Index Global score) at study entry was entered as the mediator for all analyses. Internalized stigma and perceived subtle discrimination were entered as simultaneous predictors. Age, sex, race/ethnicity, smoking status, yearly family income, and cancer stage were entered as covariates. a = direct effect of predictor on mediator. b = direct effect of mediator on outcome. c = total effect of predictor on outcome. a*b = indirect effect of predictor on outcome as explained by the mediator. c' = direct effect of predictor on outcome (after accounting for the indirect effect). CI = confidence interval from bootstrapping analyses. Bolded statistics indicate significant coefficients at $p < .05$.

Table 19

Global subjective sleep disturbance as a mediator of the association between internalized stigma, perceived subtle discrimination, and psychological and physical health outcomes at 12-week follow-up

Outcome at 12-week follow-up	**Predictor**	***a***	***p***	***b***	***p***	***c***	***p***	***a*b***	***p***	**95% CI**	***c'***	***p***
Depressive Symptoms	Internalized Stigma	**0.13**	**.016**	0.34	.233	**2.12**	**.015**	-0.05	.733	[-0.37, 0.26]	**2.18**	**.012**
	Perceived Discrimination	**4.29**	**.008**			2.34	.561	1.45	.282	[-1.20, 4.11]	0.88	.833
Global Quality of Life	Internalized Stigma	-0.28	.517	0.01	.977	**-3.13**	**.016**	<-0.01	.977	[-0.24, 0.23]	**3.12**	**.017**
	Perceived Discrimination	2.93	.067			5.54	.270	0.04	.977	[-2.41, 2.49]	5.50	.302
Cancer-specific Quality of Life	Internalized Stigma	-0.32	.471	-0.33	.552	**-3.81**	**.028**	0.11	.645	[-0.34, 0.56]	**-3.92**	**.025**
	Perceived Discrimination	**3.39**	**.034**			5.17	.433	-1.12	.569	[-4.97, 2.73]	6.29	.374
Cancer-related Anxiety	Internalized Stigma	0.05	.912	0.01	.949	**2.35**	**<.001**	<0.01	.955	[-0.02, 0.02]	**2.35**	**<.001**
	Perceived Discrimination	**3.89**	**.022**			0.60	.816	0.47	.949	[-1.41, 1.50]	0.56	.840
Physical Symptom Bother	Internalized Stigma	-0.21	.496	0.01	.634	0.05	.338	<-0.01	.698	[-0.01, 0.01]	0.06	.318
	Perceived Discrimination	**3.84**	**.002**			-0.10	.681	0.04	.639	[-0.14, 0.23]	-0.14	.579

Note: N = 101. Subjective sleep disturbance (i.e., Pittsburgh Sleep Quality Index Global score) at 6-week follow-up was entered as the mediator for all analyses. Internalized stigma and perceived subtle discrimination were entered as simultaneous predictors. Age, sex, race/ethnicity, smoking status, yearly family income, cancer stage, and the study entry value of the outcome variable were entered as covariates. a = direct effect of predictor on mediator. b = direct effect of mediator on outcome. c = total effect of predictor on outcome. a*b = indirect effect of predictor on outcome as explained by the mediator. c' = direct effect of predictor on outcome (after accounting for the indirect effect). CI = confidence interval from bootstrapping analyses. Bolded statistics indicate significant coefficients at $p < .05$.

Chapter 4: General Discussion

These studies contribute to the limited relevant literature by addressing the relationships between lung cancer stigma, perceived subtle discrimination about one's lung cancer status, and health-related adjustment, as well as the moderators and mediators of these relationships. The results of Study 1 demonstrate independent and robust relationships between higher internalized stigma, perceived discrimination, and poorer psychological and physical health-related adjustment through cross-sectional and longitudinal analyses. Study 2 extends these findings by demonstrating that perceived discrimination is also associated significantly with subjective sleep disturbance, a behavioral health outcome, in cross-sectional and longitudinal analyses. Exploratory analyses from Study 2 also suggest that internalized stigma and perceived discrimination are associated with objective indicators of sleep disturbance. Taken together, these studies demonstrate that there are robust and non-overlapping relationships between lung cancer stigma, perceived discrimination, and a range of health-related outcomes. Although causality cannot directly be inferred, the pattern of findings that stigma and discrimination significantly predicted declining psychological health and worsening sleep quality across time, respectively, support theoretical perspectives that stigma and discrimination contribute to health-related maladjustment generally (Chaudoir, Earnshaw, & Andel, 2013; Lick, Durso, & Johnson, 2013; Meyer, 2003) and in the context of lung cancer specifically (Cataldo, Slaughter, Jahan, Pongquan, & Hwang, 2011; Hamann et al., 2014).

In Study 1, internalized stigma was more robustly associated with declining psychological adjustment than perceived discrimination. It is possible that the measurement of internalized stigma (as indicated by feelings of shame, guilt, regret, and self-blame) represented negative downstream outcomes of the stigma process that are more closely related to poorer

adjustment than upstream processes such as recognition of lung cancer as a stigmatized status or awareness that others hold stigmatizing attitudes. By contrast, the measurement of perceived discrimination did not capture the ways in which people react or respond to experiences of discrimination (e.g., internal attribution, hypervigilance), which may be more closely linked with indicators of psychological adjustment. However, exploratory analyses suggest that perceived discrimination specifically from the partner is associated with worse health-related adjustment across all outcomes and that perceived discrimination from the medical team is robustly associated with poorer physical health-related outcomes cross-sectionally and over time. As such, future research should continue to consider how the health effects of perceived discrimination vary by social source. Couple-based interventions may be helpful in improving psychosocial outcomes for lung cancer patients, particularly if the intervention aims to bolster socially supportive exchanges (Manne et al., 2005) and encourages the use of adaptive coping strategies (Manne et al., 2005; Northouse et al., 2013).

With regard to moderators of the stigma-health relationship, findings from Study 1 demonstrate that higher self-compassion and lower use of avoidant coping strategies are modifiable psychological factors that can buffer relationships between stigma, discrimination, and psychological health outcomes; these findings yield several implications for theory and research. First, self-compassion and cancer-specific coping strategies should be regarded as moderators of the lung cancer stigma process in addition to other proposed psychosocial moderators such as social support and religiosity (Hamann et al., 2014). Second, self-compassion and avoidance can be targeted through psychosocial approaches (e.g., Melnyk & Shepperd, 2012; Neff & Germer, 2013), which can be tailored to the experience of lung cancer and its associated sequelae. The scientific premise of such an investigation would be to strengthen

causal inference on the buffering effects of high self-compassion and low avoidance, and the clinical importance would be to mitigate the deleterious effects of internalized stigma and perceived discrimination on health-related adjustment to lung cancer. Third, these findings suggest that self-compassion and avoidant coping may buffer the negative effects of stigma and discrimination on psychological but not physical health-related outcomes. Future research is needed to test other moderators such as perceived social support, which is a well-established predictor of physical health outcomes (Uchino, 2009).

Results from Study 2 identify subjective global sleep disturbance as a mediator through which higher perceived discrimination (but not internalized stigma) predicts poorer psychological and physical health-related outcomes in cross-sectional (but not longitudinal) analyses. Perceptions of discrimination are posited to prompt affective and physiological hypervigilance (Mays, Cochran, & Barnes, 2007), and research has demonstrated that perceptions of racial discrimination are associated with affective and physiological hyperarousal (Carter & Forsyth, 2010; Smart Richman, Pek, Pascoe, & Bauer, 2010). It is possible that perceived subtle discrimination about one's lung cancer status may prompt hypervigilance, which in turn interferes with restful sleep. Future research is needed to test other variables such as emotion dysregulation or perceived stress as mediators of the relationship between internalized stigma and poor health (Hatzenbuehler et al., 2009; McLaughlin, Hatzenbuehler, & Hilt, 2009).

Contrasting results demonstrated that higher perceived subtle discrimination was associated with shorter objective sleep duration and less objective daytime inactivity, whereas higher internalized stigma was related to longer sleep duration and more daytime inactivity. This pattern of findings suggests the possibility that mechanisms of the discrimination-health link in

lung cancer may include affective and physiological indicators of anxiety (including hypervigilance), which is associated with short sleep duration (Monti & Monti, 2000). In contrast, mechanisms of the internalized stigma-health pathway may include indicators of depression (e.g., hopelessness, elevated inflammation), which is associated with hypersomnia (Patel, Malhotra, Gottlieb, White, & Hu, 2006).

In Study 1, higher perceived discrimination was uniquely associated with higher depressive symptoms at study entry. These same findings, however, were not replicated in Study 2 when sleep-related items were removed from the outcome variable. Thus, it is likely that the significant relationships between higher perceived subtle discrimination and depressive symptoms were driven by the robust relationship between discrimination and poor sleep (as demonstrated in Study 2). By contrast, relationships between higher internalized stigma and poorer health-related outcomes remained significant (or became significant in the case of worse cancer-specific quality of life and higher cancer-related anxiety) after removing sleep-related items from the outcomes. These findings demonstrate that the stigma-health relationship is consistent whether or not sleep disturbance is included in the conceptualization of poorer health-related outcomes.

Findings from these studies yield implications for theory, research, and practice. First, theories of stigma, discrimination, and health may benefit from consideration of 1) self-compassion and coping strategies as moderators of internalized stigma and perceived discrimination on health-related adjustment to cancer; 2) the independent effects of internalized stigma and perceived discrimination on health-related adjustment as well as their distinct mechanistic pathways; and 3) how the stigma-health or discrimination-health relationship varies by social source. Next, experimental research is needed to test whether reductions in internalized

stigma facilitate positive adjustment to lung cancer; such an investigation would bolster causal inference. Research is needed to determine whether lung cancer stigma interferes with patient engagement with care, including accepting a referral to a tobacco cessation clinic at diagnosis, discussing therapeutic clinical trial participation, and having an advanced directive at the end-of-life. Additionally, future research should investigate how lung cancer stigma interacts with other perceptions of stigma and discrimination (e.g., about one's race/ethnicity or age) to predict health-related outcomes for people with multiple, co-occurring stigmatized identities or statuses (e.g., Crandall, 1991; Williamson, Mahmood, Kuhn, & Thames, 2017). Finally, patient- and health care provider-focused interventions are needed to target internalized stigma and maladaptive responses to perceived subtle discrimination in order to promote health and well-being for this underserved and understudied population (Hamann, Garland, & Ostroff, 2018; Hamann, Ver Hoeve, Carter-Harris, Studts, & Ostroff, 2018). These studies indicate that self-compassion and coping strategies are modifiable psychological processes that might be harnessed through interventions to facilitate positive adjustment and allay negative effects of stigma on health-related outcomes for adults diagnosed with lung cancer.

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