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Pain self-efficacy, race, and motivation to quit smoking among persons living with HIV (PLWH)

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HIGHLIGHTS

- Pain self-efficacy was positively related to motivation/intention to quit smoking.
- Pain self-efficacy was positively related to perceived importance of quitting.
- These associations were especially prominent among Black/African American PLWH.
- Low pain self-efficacy among PLWH may impede the initiation of smoking cessation.
- Future work should test pain self-efficacy as a predictor of cessation milestones.

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ABSTRACT

Pain and cigarette smoking are commonly co-occurring and costly public health issues, and rates of both conditions are elevated among persons living with HIV (PLWH). Recent work has focused on elucidating the role of cognitive factors in pain-smoking interrelations, and PLWH have endorsed various beliefs regarding pain and smoking. There is reason to suspect that pain self-efficacy (i.e., belief in one's ability to cope with pain) may be associated with the maintenance of smoking. However, no previous research has examined relations between pain self-efficacy and motivation to quit. The goal of this study was to conduct the first test of cross-sectional associations between pain self-efficacy and motivation to quit smoking among PLWH. Race was tested as a moderator of the hypothesized associations. Participants (N = 76 daily smokers; 37% female; M_{age} = 50.6; M_{CPD} = 13.7) were recruited from an outpatient infectious disease clinic for a primary study examining the effects of a personalized feedback intervention for PLWH. Results indicated that pain self-efficacy was positively associated with perceived importance of quitting and intention to quit within the next six months across the entire sample (ps < 0.05), and positively associated with readiness to consider smoking cessation and confidence in quitting among Black/African American participants (but not among other participants; ps < 0.05). These data provide initial evidence that pain self-efficacy may be related to motivation and intention to quit smoking, particularly among Black/African American PLWH. Future research should test prospective associations between pain self-efficacy and the initiation/maintenance of smoking cessation.

1. Introduction

Tobacco cigarette smoking and pain are commonly co-occurring public health issues, with a combined annual economic burden of more than $800 billion in healthcare expenditures and lost productivity in the United States alone (Gaskin & Richard, 2012; US Department of Health & Human Services, 2014; Xu, Bishop, Kennedy, Simpson, & Pechacek, 2015). The prevalence of current tobacco cigarette smoking is substantially higher among individuals with co-occurring pain (24–68%; e.g., Michna et al., 2004; Orhurhu, Pittelkow, & Hooten, 2015; Zvolensky, McMillan, Gonzalez, & Asmundson, 2009), relative to those in the general population (14%; Jamal et al., 2018). Rates of both pain and smoking are also elevated among persons living with Human Immunodeficiency Virus (HIV; Joint United Nations Programme on HIV/AIDS, 2016; Parker, Stein, & Jelsma, 2014; Vidrine, 2009). For example, prevalence estimates of cigarette smoking among PLWH range

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from 33 to 74% (Frazier, Sutton, Brooks, Shouse, & Weiser, 2018; Lindayani, Yeh, Ko, & Ko, 2019; Mdodo et al., 2015; Vidrine, 2009). Although rates of smoking among PLWH have declined over the past decade, PLWH continue to be significantly more likely to report current smoking compared to individuals in the general U.S. population (Frazier et al., 2018). Moreover, up to 83% of PLWH endorse past three-month pain (Parker et al., 2014), and PLWH who smoke cigarettes tend to report greater pain intensity and physical impairment, relative to non-smoking PLWH (Patel, Talwar, Reichert, Brady, Jain, & Kaplan, 2006; Turner et al., 2001). Tobacco smoking may also reduce the efficacy of HIV treatment, and increase risk of morbidity and mortality (e.g., via decreased response to antiretroviral treatment, impaired immune functioning, reduced cognitive functioning, decreased lung functioning and increased rates of cardiovascular diseases; Kariuki et al., 2016; Shirley, Kaner, & Glesby, 2013).

An established reciprocal model proposes that pain and smoking interact in the manner of a positive feedback loop, resulting in greater pain and the maintenance of tobacco dependence (Ditre, Brandon, Zale, & Meagher, 2011; Ditre, Zale, & LaRowe, 2019; Zale, Maisto, & Ditre, 2016). Consistent with this perspective, there is accumulating evidence that pain plays an important role in the onset, progression, and continuation of cigarette smoking (e.g., Ditre et al., 2011; Ditre, Zale, et al., 2019). Pain can be a potent motivator of smoking (e.g., Dhingra et al., 2014; Ditre & Brandon, 2008), and smokers often report using cigarettes to cope with pain (Hooten et al., 2011; Patterson et al., 2012). There is evidence that smokers with co-occurring pain (vs. no pain) report greater difficulty and lower confidence in quitting (Zale, Ditre, Dorfman, Heckman, & Brandon, 2014). Smokers with pain have also been shown to identify pain as a barrier to cessation and anticipate more severe nicotine withdrawal (Ditre, Kosiba, Zale, Zvolensky, & Maisto, 2016).

Recent work has focused on elucidating the role of cognitive factors, such as beliefs and expectancies, in pain-smoking interrelations (e.g., Ditre, Zale, Heckman, & Hendricks, 2017; Ditre, Zale, et al., 2019; Weinberger, Seng, Ditre, Willoughby, & Shuter, 2018). PLWH hold a variety of beliefs regarding pain and smoking (e.g., pain as a motivator for smoking, smoking for pain coping, pain as a barrier to quitting; Weinberger et al., 2018), and such beliefs have been positively associated with tobacco dependence, pain severity, and functional impairment among smokers with chronic pain (Ditre et al., 2017). Self-efficacy expectancies for pain management (i.e., belief that one can successfully cope with pain), in particular, have been hypothesized to play a mechanistic role in bidirectional pain-smoking effects (Ditre et al., 2011; Ditre, Zale, et al., 2019).

Lower pain self-efficacy has been associated with pain-related activity avoidance, increased pain, greater use of pain medications, and the transition from acute to chronic pain (Council, Ahern, Follick, & Kline, 1988; Jackson, Wang, Wang, & Fan, 2014; Keefe, Rumble, Scipio, Giordano, & Perri, 2004). Nicotine has been shown to confer acute analgesia (Ditre, Heckman, Zale, Kosiba, & Maisto, 2016), and smokers often report using cigarettes to cope with pain (Hooten et al., 2011; Patterson et al., 2012). It has been suggested that smokers with lower confidence in their ability to manage pain may come to rely on smoking for pain relief, and may be less willing to consider cessation (e.g., given that pain can increase during the early stages of abstinence; Ditre, Zale, LaRowe, Kosiba, & De Vita, 2018; LaRowe, Kosiba, Zale, & Ditre, 2018). However, no research has examined relations between pain self-efficacy and motivation to quit smoking.

The goal of present study was to conduct the first test of cross-sectional associations between pain self-efficacy and motivation to quit smoking, among PLWH who are also current daily cigarette smokers. This study involved secondary analyses of baseline data collected for a parent study examining the efficacy of a computer-based personalized feedback intervention for PLWH (Ditre et al., 2019). We hypothesized that pain self-efficacy would be positively associated with readiness to consider smoking cessation, perceived importance of quitting smoking, readiness to engage a cessation attempt, confidence in successfully quitting, and intention to quit within the next six months. Given that both pain and smoking trajectories have been shown to vary as a function of race (e.g., Merry et al., 2011; Piper et al., 2010), we also conducted analyses examining race as moderator of the hypothesized associations between pain-self efficacy and motivation to quit smoking.

2. Method

2.1. Participants

Participants were recruited from a university hospital-based outpatient infectious disease clinic for a parent study examining the efficacy of a computer-based personalized feedback intervention for tobacco cigarette smoking PLWH with co-occurring pain (Ditre et al., 2019). These data were collected at baseline, which occurred prior to randomization. Inclusion/exclusion criteria were consistent with those of the parent student (Ditre et al., 2019). Specifically, participants were included if they endorsed current tobacco cigarette smoking, use of prescription analgesic medication, and age greater than 30. Participants were excluded if they reported currently attempting to quit smoking. A total of 76 participants met these inclusion/exclusion criteria and attended a baseline assessment.

2.2. Measures

2.2.1. Self-efficacy for pain management

Self-efficacy for pain management was measured using the pain self-efficacy (PSE) subscale of the Chronic Pain Self-Efficacy Scale (Anderson, Dowds, Pelletz, Edwards, & Peeters-Asdourian, 1995). The PSE consists of 5 items (e.g., "How certain are you that you can decrease your pain quite a bit?") that are rated on a scale ranging from 1 (*very uncertain*) to 10 (*very certain*). The PSE is a valid and reliable measure of self-efficacy for pain management, and has been shown to predict pain severity, daily interference due to pain, general activity level, affective distress, and perceived life control (Anderson et al., 1995; Miles, Pincus, Carnes, Taylor, & Underwood, 2011). Internal consistency was good in the current sample ($\alpha = 0.87$).

2.2.2. Pain characteristics

Pain characteristics were assessed via self-report. First, participants were asked to indicate their primary pain location (i.e., location that hurt the most over the past three months). Response options consisted of back, head, face, neck, shoulders, arms, hands, chest, breast, stomach, abdomen, hips, legs, and feet. Second, a single item was used to assess pain duration ("How long have you been experiencing this type of pain?"; CDC, 2007). Current pain intensity was assessed using a numerical rating scale (NRS; e.g., Hawker, Mian, Kendzerska, & French, 2011) ranging from 0 (*no pain*) to 10 (*pain as bad as you can imagine*).

2.2.3. Readiness to consider smoking cessation

The Contemplation Ladder (Biener & Abrams, 1991) was used to assess readiness to consider initiating a quit attempt. Participants completed a single item comprised of a visual analogue scale with response options ranging from 0 (*no thought of quitting*) to 10 (*taking action to quit*). This measure has demonstrated strong convergent and concurrent validity (e.g., Amodei & Lamb, 2004).

2.2.4. Motivation to quit smoking

The Rulers for Smoking Cessation (Boudreaux et al., 2012) are commonly used to assess motivation to quit tobacco cigarette smoking. Three items assess importance ("How important is stopping smoking to you?" 0 = *Not important at all*; 10 = *Most important goal of my life*), readiness ("How ready are you to quit smoking within the next month?" 0 = *Not at all*; 10 = *100% ready*), and confidence in quitting ("How confident are you that you will quit smoking within the next month?"

0 = *Not at all*; 10 = *100% confident*). These rulers have been associated with smoking behavior change, such that individuals who endorse greater motivation to quit are more likely to initiate a cessation attempt (Boudreaux et al., 2012).

2.2.5. Intention to quit smoking

A single item was used to assess intention (yes/no) to quit smoking within the next six months ("Are you seriously considering quitting smoking within the next six months?"). This item has previously been used to assess intention to quit in national surveys (e.g., The Health Information National Trends Survey; Nelson et al., 2004).

2.2.6. Sociodemographic and smoking characteristics

A range of sociodemographic (e.g., age, gender, race/ethnicity, education, and income) and smoking characteristics (e.g., number of cigarettes smoked per day [CPD], number of years smoking) were assessed via self-report. Cigarette dependence was measured using the Heaviness of Smoking Index (HSI; Heatherton, Kozlowski, Frecker, Rickert, & Robinson, 1989), which is comprised of two items (i.e., "How soon after you wake up do you smoke your first cigarette?" and "How many cigarettes per day do you smoke?"; Heatherton et al., 1989). For the first item, responses are scored as follows: 0 (> 60 min), 1 (31–60 min), 2 (6–30 min), 3 (≤5 min). For the second item, responses are scored as follows: 0 (1–10 CPD), 1 (11–20 CPD), 2 (21–30 CPD), 3 (> 30 CPD). Items are summed to generate a total score (range 0–6), with higher scores indicating greater levels of cigarette dependence.

2.3. Data analysis

We conducted separate hierarchical linear regression models to test associations between pain self-efficacy and (1) readiness to consider smoking cessation, (2) importance of quitting smoking, (3) readiness to quit in the next month, and (4) confidence in quitting in the next month. We also conducted a hierarchical logistic regression model to test associations between pain self-efficacy and likelihood of seriously considering quitting smoking within the next 6 months. Given previously observed associations with cessation-relevant outcomes, gender, age, cigarette dependence, and current pain intensity were included as covariates in each model (Coambs, Li, & Kozlowski, 1992; Kozlowski, Porter, Orleans, Pope, & Heatherton, 1994; Wetter et al., 1999; Zale et al., 2014). For each model, predictors were entered in the following order: Step 1 (gender, age, cigarette dependence, current pain intensity); Step 2 (pain self-efficacy, race (Black/African American vs. other); Step 3 (pain self-efficacy × race interaction). We interpreted the main effects of pain self-efficacy on each outcome variable by examining results at Step 2 of each model. We then interpreted the PSE × race interaction by examining results at Step 3 of each model. Significant interactions were probed by testing the conditional effects of pain self-efficacy at each level of race (black/African American vs. other).

3. Results

3.1. Participant characteristics

Participants included 76 current daily tobacco smokers (63.2% male; M_{age} = 50.62, *SD* = 9.59), who reported smoking approximately 14 cigarettes per day (*M* = 13.72, *SD* = 11.97) for an average of nearly 29 years (*M* = 28.92, *SD* = 10.03). The mean HSI score was 2.74 (*SD* = 1.56), indicating a low-to-moderate level of cigarette dependence. About half of the sample identified as black or African American (48.7%), and black/African American participants did not differ from participants of other races on any sociodemographic, smoking, or pain characteristics (all *ps* > 0.05). Across the sample, less than half (38.1%) reported education beyond high school and over 50% reported an annual income of less than $10,000. Participants reported a mean current pain intensity of 4.76 (*SD* = 3.67), and most reported that their primary pain location was either in the neck/back (47.4%) or lower extremities (36.8%). Additional sociodemographic and clinical data are presented in Table 1.

Table 1
Sociodemographic, smoking, and pain characteristics.

	Black/African American *n* = 37	Other Races *n* = 39	Total N = 76
	n (%)	*n* (%)	*n* (%)
Gender			
Female	15 (40.5%)	13 (33.3%)	28 (36.8%)
Race *			
White	0 (0.0%)	30 (76.9%)	30 (39.5%)
Black or African American	37 (100.0%)	0 (0.0%)	37 (48.7%)
American Indian/Alaska Native	0 (0.0%)	9 (23.1%)	9 (11.8%)
Ethnicity			
Hispanic	2 (5.4%)	6 (15.4%)	8 (10.5%)
Income			
< $10,000	21 (56.8%)	18 (46.2%)	39 (51.3%)
$10,000–$29,999	14 (37.8%)	14 (35.9%)	28 (36.8%)
$30,000–$49,999	2 (5.4%)	7 (17.9%)	9 (11.8%)
Education			
Did not graduate high school	13 (35.1%)	16 (41.0%)	29 (38.2%)
High school graduate	10 (27.0%)	8 (20.5%)	18 (23.7%)
Some college/Technical school/ Associate's degree	12 (22.4%)	13 (33.3%)	25 (32.9%)
At Least a 4-year college degree	2 (5.4%)	2 (5.1%)	4 (5.2%)
Primary pain location			
Neck/Back	15 (40.5%)	21 (53.8%)	36 (47.4%)
Lower Extremity	15 (40.5%)	13 (33.3%)	28 (36.8%)
Upper Extremity	4 (10.8%)	1 (2.6%)	5 (6.6%)
Chest	0 (0.0%)	1 (2.6%)	1 (1.3%)
Stomach	0 (0.0%)	2 (5.1%)	2 (2.6%)
Head	3 (8.1%)	1 (2.6%)	4 (5.3%)
Pain duration			
< 3 months	5 (13.5%)	2 (5.1%)	7 (9.2%)
3–12 months	3 (8.1%)	10 (25.6%)	13 (17.1%)
> 12 months	29 (78.4%)	27 (69.2%)	56 (73.7%)
Intention to quit in next six months			
Yes	31 (83.8%)	28 (71.8%)	59 (77.6%)
	M (SD)	M (SD)	M (SD)
Age	51.57 (11.15)	49.72 (7.87)	50.62 (9.59)
Current pain intensity[a]	5.22 (3.71)	4.33 (3.62)	4.76 (3.67)
Years smoking	28.14 (10.03)	29.67 (10.09)	28.92 (10.03)
Cigarettes per day	11.70 (13.54)	15.64 (10.06)	13.72 (11.97)
Cigarette dependence[b]	2.51 (1.56)	2.95 (1.56)	2.74 (1.56)
Contemplation ladder	4.86 (3.47)	6.10 (3.42)	5.50 (3.48)
Importance of quitting[c]	7.62 (3.23)	6.92 (3.47)	7.26 (3.35)
Readiness to quit[c]	4.84 (3.69)	4.90 (3.68)	4.87 (3.66)
Confidence in quitting[c]	4.46 (3.66)	3.44 (3.80)	3.93 (3.74)
Pain self-efficacy[d]	25.32 (12.51)	22.33 (14.66)	23.79 (13.65)

Note. [a] NRS, [b] Heaviness of Smoking, [c] Rulers for Smoking Cessation, [d] Chronic Pain Self-Efficacy Scale; * $p < .05$.

3.2. Contemplation ladder scores

Pain self-efficacy was not independently associated with contemplation ladder scores ($p = .357$). The PSE × race interaction term was, however, positively associated with contemplation ladder scores (Step 3: β = 0.54, $p = .048$; $\Delta R^2 = 0.05$, $p = .048$; Table 2), accounting for 5% of the total variance. Conditional effects revealed a positive association between pain self-efficacy and readiness to consider smoking cessation among Black/African American participants ($b = 0.10$, $SE = 0.05$, $p = .04$), but not among participants of other races ($b = -0.02$, $SE = 0.04$, $p = .54$; Fig. 1).

Table 2
Associations between pain self-efficacy and motivation to quit.

	Model 1			Model 2			Model 3		
Variable	*β*	*t*	*p*	*β*	*t*	*p*	*β*	*t*	*p*
Contemplation Ladder									
Gender	−0.08	−0.65	0.52	−0.11	−0.91	0.37	−0.07	−0.56	0.58
Age	−0.19	−1.66	0.10	−0.18	−1.56	0.12	−0.23	−1.99	0.05
Cigarette Dependence [a]	−0.09	−0.81	0.42	−0.10	−0.89	0.38	−0.11	−1.00	0.32
Pain Intensity [b]	−0.09	−0.81	0.42	−0.06	−0.49	0.62	−0.07	−0.61	0.55
Pain Self-Efficacy [c]				0.11	0.93	0.36	−0.09	−0.62	0.54
Race				−0.19	−1.62	0.11	−0.60	−2.56	0.01
Pain Self-Efficacy × Race							0.54	2.02	0.04
R^2	0.07			0.11			0.16		
ΔR^2	0.07			0.04			0.07		
F for ΔR^2	1.29			1.56			4.06*		
Importance of Quitting									
Gender	0.10	0.83	0.41	0.04	0.36	0.72	0.06	0.53	0.60
Age	0.09	0.75	0.45	0.08	0.70	0.49	0.05	0.47	0.64
Cigarette Dependence [a]	−0.29	−2.53	0.01	−0.25	−2.28	0.03	−0.26	−2.33	0.02
Pain Intensity [b]	0.14	1.26	0.21	0.19	1.68	0.09	0.19	1.60	0.11
Pain Self-Efficacy [c]				0.27	2.37	0.02	0.17	1.12	0.27
Race				0.01	0.11	0.92	−0.19	−0.82	0.41
Pain Self-Efficacy × Race							0.26	1.00	0.32
R^2	0.12			0.19			0.20		
ΔR^2	0.12			0.07			0.01		
F for ΔR^2	2.44			2.88			1.00		
Readiness to Quit in the Next Month									
Gender	−0.04	−0.34	0.74	−0.08	−0.67	0.51	−0.06	−0.47	0.64
Age	−0.06	−0.46	0.65	−0.06	−0.47	0.64	−0.08	−0.68	0.50
Cigarette Dependence [a]	−0.04	−0.37	0.71	−0.03	−0.24	0.81	−0.04	−0.29	0.77
Pain Intensity [b]	0.12	1.01	0.31	0.16	1.32	0.19	0.15	1.26	0.21
Pain Self-Efficacy [c]				0.19	1.57	0.12	0.08	0.47	0.64
Race				−0.05	−0.45	0.66	−0.28	−1.15	0.25
Pain Self-Efficacy × Race							0.30	1.07	0.28
R^2		0.02			0.06			0.17	
ΔR^2		0.02			0.06			0.02	
F for ΔR^2		0.39			1.26			1.14	
Confidence in Quitting in the Next Month									
Gender	−0.04	−0.36	0.72	−0.08	−0.68	0.50	−0.03	−0.28	0.78
Age	0.02	0.14	0.89	0.01	0.05	0.96	−0.05	−0.45	0.65
Cigarette Dependence [a]	−0.13	−1.1	0.26	−0.10	−0.86	0.39	−0.11	−0.99	0.325
Pain Intensity [b]	0.14	1.1	0.25	0.17	1.39	0.17	0.15	1.31	0.19
Pain Self-Efficacy [c]				0.21	1.74	0.09	−0.03	−0.20	0.84
Race				0.07	0.62	0.54	−0.41	−1.75	0.09
Pain Self-Efficacy × Race							0.63	2.36	0.02
R^2		0.05			0.10			0.16	
ΔR^2		0.05			0.05			0.07	
F for ΔR^2		0.85			1.88			5.55*	

Note: β = standardized beta weights; Race: 1 = black/African American, 0 = other; [a] Heaviness of Smoking Index, [b] NRS, [c] Chronic Pain Self-Efficacy Scale; * $p < .05$.

3.3. Rulers for smoking cessation

Pain self-efficacy was positively associated with importance of stopping smoking (Step 2: β = 0.27, $p = .021$; Table 2). There was also a trend-level positive association between pain self-efficacy and confidence in quitting (β = 0.21, $p = .087$). Moreover, the PSE × race interaction term was significantly associated with confidence in quitting smoking (Step 3: β = 0.63, $p = .021$; $\Delta R^2 = 0.07$, $p = .021$; Table 2), accounting for 7% of the total variance. Conditional effects revealed a positive association between pain self-efficacy and confidence in quitting among Black/African American participants ($b = 0.14$, $SE = 0.05$, $p = .004$), but not among participants of other races ($b = -0.01$, $SE = 0.04$, $p = .839$; Fig. 2). Finally, pain self-efficacy was not associated with readiness to quit smoking in the next month ($p = .121$; Table 2), and the PSE × race interaction term was not associated with perceived importance of quitting smoking ($p = .320$), or readiness to quit smoking in the next month ($p = .288$).

3.4. Intention to quit in the next six months

There was a positive association between pain self-efficacy and likelihood of considering cessation in the next six months (Step 2: AOR = 1.05, CI: 1.00–1.11, $p = .040$; See Table 3). Specifically, every 1-point increase in scores on the measure of pain self-efficacy (range: 5–50) was associated with a 5% increased likelihood of considering quitting smoking. The pain × PSE interaction term was not associated with the likelihood of endorsing intention to quit smoking in the next six months ($p = .389$).

4. Discussion

This is the first study to examine associations between pain self-efficacy and motivation to quit smoking among PLWH. Results indicated that higher pain self-efficacy was associated with greater perceived importance of quitting smoking, and a greater likelihood of considering cessation within the next six months. Among Black/African American participants (but not those of other races), pain self-efficacy was also associated with readiness to contemplate smoking cessation

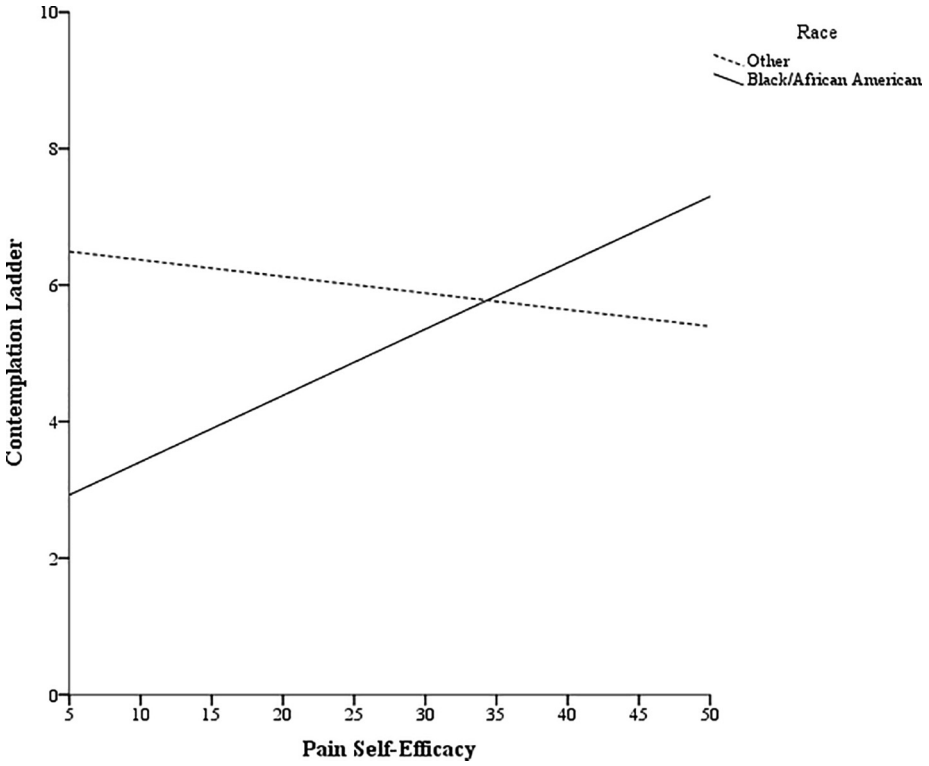

Fig. 1. Conditional effects of pain self-efficacy on contemplation ladder scores as a function of race.

and confidence in quitting smoking. These findings suggest that pain self-efficacy may be an important cognitive construct to consider when assessing and addressing motivation to quit among PLWH smokers with co-occurring pain. The prevalence of HIV is higher among Black/African American individuals than those of any other race (Linley, Johnson, Song, Wu, Hu, Singh, & Hernandez, 2019), and the current data provide evidence that pain self-efficacy may be particularly important among this population.

The current findings contribute to a growing empirical literature indicating that pain and pain-related factors can influence quit-relevant outcomes (e.g., Ditre et al., 2011; Ditre, Kosiba, et al., 2016; Ditre, Zale, et al., 2019; Zale et al., 2014). Previous work has found that smokers

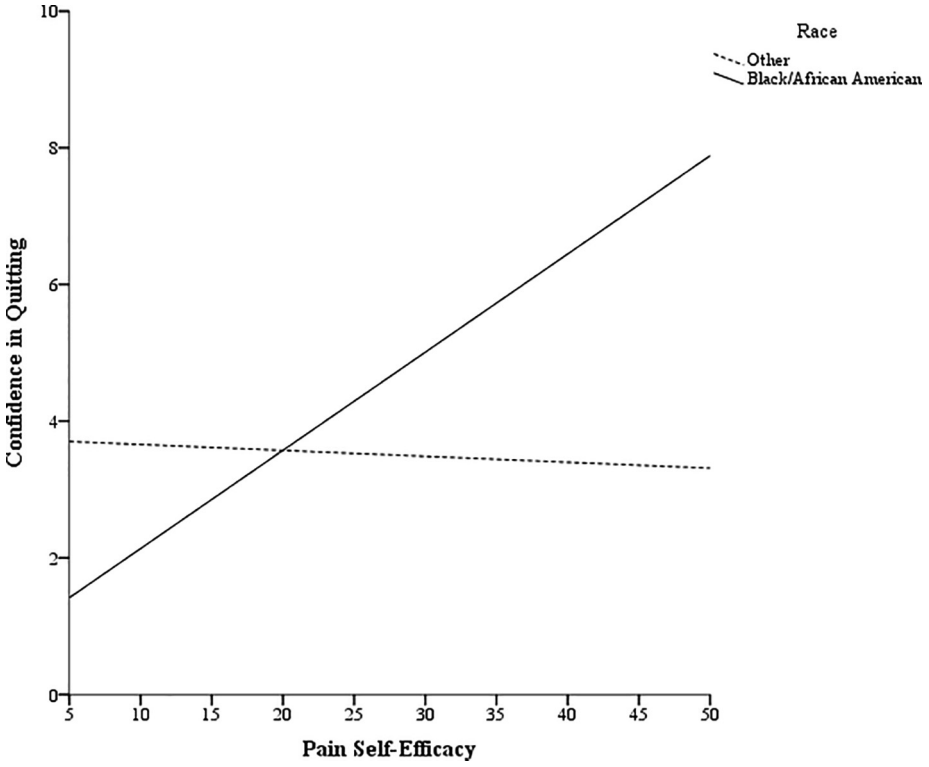

Fig. 2. Conditional effects of pain self-efficacy on confidence in quitting as a function of race.

Table 3
Logistic regression: odds of considering cessation in the next six months.

Variable	*B*	*SE*	AOR	95% CI	*p*
Gender (female)	0.03	0.69	1.03	0.27–3.97	0.97
Age	−0.02	0.03	0.98	0.92–1.05	0.62
Cigarette Dependence [a]	−0.26	0.21	0.77	0.51–1.17	0.23
Pain Intensity [b]	0.25	0.10	1.28	1.06–1.54	< 0.01*
Race (Black/African American)	0.43	0.64	1.54	0.44–5.33	0.50
Pain Self-Efficacy [c]	0.05	0.03	1.05	1.00–1.11	0.04*

Note: Results shown are from the second step of the logistic regression model; AOR = adjusted odds ratio; [a] Heaviness of Smoking Index, [b] NRS, [c] Chronic Pain Self-Efficacy Scale; * $p < .05$.

with pain (vs. without pain) report greater difficulty quitting, lower confidence for future smoking abstinence, and that pain is viewed as a barrier to cessation (Ditre, Kosiba, et al., 2016; Zale et al., 2014). The current results extend this work by indicating that PLWH smokers who have greater confidence in managing their pain may also be more motivated to engage a cessation attempt (relative to those with lower pain self-efficacy). Indeed, smokers who are more confident in their ability to manage pain may be less likely to rely on nicotine to cope (e.g., Grover, Gonzalez, & Zvolensky, 2013; Khantzian, 1997), and consequently, more likely to consider quitting.

Contrary to hypothesis, pain self-efficacy was not associated with contemplation ladder scores or readiness to consider cessation in the next month among the full sample, and there was only a trend-level association between pain self-efficacy and confidence in quitting. However, these findings should not be over-interpreted, particularly given the study limitations outlined below (e.g., small sample size). Future research is needed to clarify associations between pain self-efficacy and readiness to quit smoking among larger and more diverse samples. It is also important to note that a significant pain self-efficacy X race interaction was observed, such that pain self-efficacy was positively associated with contemplation ladder scores and confidence in quitting among Black/African American (but not other) participants. Previous research has consistently demonstrated that Black/African American individuals are less likely to successfully quit smoking (e.g., Campbell & Edwards, 2012; Kulak, Cornelius, Fong, & Giovino, 2016; Mossey, 2011). Black/African American individuals have further been shown to report lower self-efficacy for physical functioning, less perceived control over pain, and greater use of passive pain-coping strategies (e.g., Campbell & Edwards, 2012; Lefebvre et al., 1999; Tan, Jensen, Thornby, & Anderson, 2005). Thus, Black/African American PLWH smokers who endorse lower confidence in their ability to manage their pain may also be less willing to consider quitting (e.g., due to a greater reliance on maladaptive pain coping strategies such as distraction via tobacco use). Taken together, results of this study suggest that future work would benefit from further examining associations between pain self-efficacy, race, and motivation to quit smoking.

Clinical research has demonstrated positive relations between pain self-efficacy and pain-related outcomes (Anderson et al., 1995), and these data provide initial evidence that greater pain self-efficacy may also be associated with increased motivation to quit smoking among PLWH. Collectively, these findings underscore the importance of assessing pain self-efficacy among cigarette smokers with co-occurring pain, particularly those who are Black/African American. Pain self-efficacy may also warrant consideration as a transdiagnostic factor in comorbid pain and tobacco dependence (e.g., LaRowe, Zvolensky, & Ditre, 2018), and further elucidating the role of pain-self efficacy in pain-smoking interrelations may help to inform the development of novel treatments. For example, tailored interventions that aim to increase confidence in ability to cope with pain (e.g., by teaching smokers to use more adaptive pain-coping strategies), may simultaneously enhance motivation to quit smoking.

Several limitations and directions for future research should be noted. First, and perhaps most notably, the current sample was relatively small. Whereas some researchers correctly note that low statistical power can reduce the likelihood that a statistically significant result reflects a true effect (Button et al., 2013), others suggest that it can be beneficial to study smaller samples during the early stages of hypothesis testing (e.g., reduces time and cost, helps generate initial estimates). This study is the first to test associations between pain self-efficacy and substance-related outcomes, and although results should be interpreted with caution, these findings suggest that future research and replication (particularly among larger samples) are warranted. Second, the sample was limited to PLWH, and future work should examine associations between pain self-efficacy and motivation to quit smoking among less specific samples of smokers (e.g., those without HIV). Third, although most of the sample (91%) reported pain lasting longer than 3 months, participants were not recruited based on chronic pain status, and future studies should test relations between pain self-efficacy and motivation to quit among treatment-seeking chronic pain patients. Fourth, participants in this sample reported low-to-moderate levels of cigarette dependence, and future research should examine associations between pain self-efficacy and motivation to quit among heavier and treatment-seeking smokers. Fifth, this study was cross-sectional in nature, and additional research is needed to test whether pain self-efficacy has predictive utility in the initiation and maintenance of smoking cessation. Finally, future work should examine associations between pain self-efficacy and motivation to reduce other substance use (e.g., alcohol, cannabis, prescription opioids).

In summary, results of this study represent an initial, yet important, step towards better understanding the role of pain self-efficacy in the context of motivation to quit smoking among PLWH. These data provide the first evidence that greater confidence in managing pain may be associated with increased desire and readiness to engage smoking cessation. It was further revealed that pain self-efficacy may be especially relevant to cessation motivation among Black/African American PLWH. This type of work has the potential to inform the development of tailored motivational interventions for PLWH who are current daily cigarette smokers.

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CRediT authorship contribution statement

Lisa R. LaRowe: Formal analysis, Investigation, Writing - original draft. **Yvette Rother:** Formal analysis, Writing - original draft. **Jessica M. Powers:** Formal analysis, Writing - original draft. **Michael J. Zvolensky:** Conceptualization, Methodology, Writing - review & editing. **Peter A. Vanable:** Conceptualization, Methodology, Investigation, Writing - review & editing. **Joseph W. Ditre:** Conceptualization, Methodology, Investigation, Writing - review & editing, Project administration, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.addbeh.2020.106318.

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