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Health-Related Quality of Life (HRQoL) Among Homeless Smokers: Risk and Protective Factors of Latent Class Membership

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Abstract

Purpose—Health-related quality of life (HRQoL) is a multidimensional assessment of well-being and health status. Most previous work in this area assumes that HRQoL is a homogenous construct; however, it is possible HRQoL subgroups may exist. The purpose of the study was to characterize common classes of HRQoL among adult, homeless smokers, a particularly vulnerable group of the larger population, and to evaluate risk and protective factors of HRQoL class membership.

Methods—Homeless smokers (N = 456; 65.1% male; M_{age} = 43.19 years [SD = 11.77]) completed self-report measures of sociodemographics, smoking characteristics, anxiety sensitivity, stress, social support, and the Center for Disease Control (CDC) four-item HRQoL measure. A latent class analysis was conducted for HRQoL. Multinomial regression models were used to simultaneously test correlates of class membership.

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Compliance with Ethical Standards

Disclosure of Potential Conflicts of Interest

The authors declare that they have no conflicts of interest.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individuals participating in the study.

Results—A three-class solution, consisting of poor HRQoL, moderate HRQoL, and excellent HRQoL, demonstrated superior fit. Correlates of class membership included sex, age, lifetime months of being homeless, smoking characteristics, anxiety sensitivity, stress, and social support.

Conclusions—The current findings provide novel evidence for three distinct classes of HRQoL among homeless smokers. Results suggest that older smokers with greater emotional distress, as evidenced by greater anxiety sensitivity and stress and less social support, may be particularly vulnerable to poorer HRQoL.

Keywords

Health Related Quality of Life; Latent Class Analysis; Homeless; Smokers; Socioeconomically Disadvantaged; Tobacco Use

Health-related quality of life (HRQoL) is a multidimensional assessment of well-being and health status that captures both physical and mental health.[1] HRQoL can help determine how disease, injury, and disability impact physical and mental health problems that are not disease or disorder-specific.[1] Current working definitions of health define it as a 'state of complete physical, mental, and social well-being—not merely the absence or presence of disease or infirmity'.[2] Consistent with this global definition, HRQoL goes beyond traditional objective indicators of health to capture subjective perceptions of health that contribute to overall well-being.[3] Clinically, poorer HRQoL is strongly associated with higher mortality rates and a higher prevalence of disability from myriad health conditions.[4,5]

The HRQoL Center for Disease Control (CDC) measure is commonly used to evaluate HRQoL.[1] This measure assesses four unique, but related, domains of HRQoL, including self-rated health, poor mental and physical health days, and activity limited days due to poor physical or mental health.[1] The majority of work with the CDC HRQoL measure has been based on the assumption that participants within specific samples come from a homogeneous population.[6] For example, prior work has primarily modeled the CDC HRQoL measure aggregated across an entire sample. However, work with other measures of HRQoL suggests that there may be heterogeneous subgroups.[7–10] Indeed, work with the 9-item CDC HRQoL measure suggests HRQoL subgroups are characterized by good mental and physical HRQoL, poor mental HRQoL, poor physical HRQoL, and poor mental and physical HRQoL.[10] At the item level, select CDC HRQoL items are often aggregated or evaluated independently, but rarely examined concurrently in their raw form. However, aggregated scores may mask important HRQoL differences and heterogeneity among respondents or the existence of subgroups of individuals who report differences in HRQoL across the specific domains despite the similar aggregated scores. Additionally, examining the items independently does not address the crux of HRQoL across its several domains. Considering that this brief measure has received considerable attention and validation as a clinical tool,[1,6] a clear 'next-step' in this area of research is to examine the four-item CDC HRQoL measure at the person-level to better understand limitations and heterogeneity in this measure. Such work may provide further justification to use the four-item CDC measure rather than lengthier measures and has the potential to inform personalized treatment planning.

HRQoL among Homeless Smokers

Extant work on eliciting HRQoL classes has focused primarily on specific vulnerable subgroups, such as those diagnosed with HIV/AIDS or cancer.[7–9] In doing so, other subgroups have been missed. One particularly vulnerable group that has been overlooked in this literature is adult smokers who are homeless. Cigarette smoking is posited to explain a considerable proportion of poorer health outcomes experienced by adults who are homeless.[11,12] Prevalence estimates for current smoking among current and chronically homeless individuals in the U.S. range from 70-80%.[13,14] This prevalence is nearly five times the national average of 15% and nearly three times the rate of those who live below the poverty line (26%).[15–17] Despite the high smoking prevalence, most smokers who are homeless desire to quit (e.g., 84%[18]), possibly as a result of the severe negative smoking-related consequences they experience including lung disease and various types of cancers.[19–22] Indeed, cigarette smoking may exacerbate existing health conditions or harm general health status, which is likely already compromised by poor nutrition, substance use, diseases, mental illness, and limited access to care among homeless adults.[13,23–28] Consequently, homeless smokers report significantly more poor mental health days relative to low-income domiciled smokers.[29] This is consistent with epidemiological work that indicates a relation between poorer HRQoL and tobacco use,[30] implicating poorer HRQoL as a potential tobacco-related negative health consequence. Despite the negative impact of smoking on health and HRQoL domains among homeless adult smokers, no work has focused on latent classes that may underpin HRQoL among this vulnerable group. Identifying systematic differences in self-reported health among respondents, i.e., identifying latent classes of HRQoL, may help refine current understanding for how smoking and housing status impact perceived health across multiple domains among homeless smokers.

Risk Factors of HRQoL Status

Certain sociodemographic factors may pose an increased risk for poorer HRQoL. Indeed, sex differences have been observed for HRQoL such that women tend to report poorer HRQoL than men.[31] Age-related differences across HRQoL also have been reported and suggest that increased age is associated with decreased healthy days.[1] Furthermore, extant work has identified education and income as unique factors related to HRQoL.[1] In addition to these sociodemographic variables, factors related to the vulnerable population of homeless smokers may contribute to poorer HRQoL. For example, the length of time one reports being homeless and the severity of their smoking may negatively impact their perceived HRQoL. These variables, although important to the collective understanding of HRQoL, have yet to be evaluated as factors related to HRQoL class membership.

Moreover, prior work has largely ignored psychological factors that may impact HRQoL class membership. Beyond depressive symptoms,[7,9] no affective vulnerabilities have been evaluated. One promising affective vulnerability that may emerge as an important factor associated with HRQoL class membership is anxiety sensitivity, which is the tendency to fear anxiety-related sensations.[32] Anxiety sensitivity is an emotional vulnerability factor related to a wide variety of health behaviors,[33–35] including smoking.[36] Anxiety sensitivity also is associated with poorer HRQoL in panic patients[37] and chronic pain patients.[38,39] To

our knowledge, however, anxiety sensitivity has not been evaluated as a predictor of HRQoL class membership or among a sample of homeless smokers. Moreover, stress more generally has not been investigated as a potential factor related to HRQoL class membership. Yet, extant work has identified perceived stress as a risk factor for poorer HRQoL among homeless smokers[40] and life stress, more broadly, has demonstrated predictive validity for poorer physical and mental HRQoL.[41] This work has been limited, however, in that it has examined HRQoL domains independently and thereby does not enhance understandings for global HRQoL at the person level. Indeed, no work has evaluated anxiety sensitivity or stress as factors related to HRQoL in a latent class model. Elucidating psychological risk processes for HRQoL may help clinicians develop more personalized treatment plans.

Protective Factors of HRQoL Status

Little work has been conducted to identify protective factors of poorer HRQoL class membership. Of potential protective factors, social support is one of the most robust predictors of health.[42,43] Theoretical models posit that perceived social support acts as a buffer against stressful events on health.[44–46] Specifically, according to the stress-buffering hypothesis,[44] social support can protect against the potential pathogenic effects of stress. Consistent with this theory, prior work has identified social support as a protective factor against poorer HRQoL.[47] Thus, social support appears to not only be a protective process for indicators of physical health, but also for subjective experiences of health. Despite promising evidence supporting the premise that social support may act as a buffer against poor HRQoL, prior work has not examined social support in the context of HRQoL class membership.

The Current Study

Collectively, empirical data and theoretical models converge to support the idea that multiple domains of life impact HRQoL,[48] such as sociodemographics, smoking characteristics, and psychological factors. Importantly, these variables have been evaluated primarily in relation to individual HRQoL domains; yet, HRQoL is conceptualized as a broader construct that encompasses several domains. To more thoroughly evaluate and capture how these potential risk and protective factors relate to HRQoL across its multiple domains, it is essential to examine how these factors might relate to HRQoL class membership. Essentially, combining latent class analysis (LCA), a person-centered analytic method used to identify latent groups, or classes, of individuals with similar characteristics that differentiate them from other groups or classes,[49] and regression analyses may provide a more complete representation of homeless smokers' self-reported functioning as well as factors that may promote or impede better functioning. As a result, such work may have the potential to inform individual treatment that could lead to improved HRQoL over time.

The primary purpose of the current study was to characterize common classes of HRQoL among adult, homeless smokers. For the present study, the four-item CDC measure of HRQoL was employed to identify unique classes of HRQoL. LCA was used to evaluate the CDC HRQoL measure and elucidate putative subgroups. The secondary purpose of the present study was to evaluate unique factors that relate to HRQoL class membership.

Hypotheses

Hypothesis 1: unique latent classes of HRQoL would emerge. Several class models would be tested and compared to identify the most appropriate class structure.

Hypothesis 2: consistent with extant work,[9,10] demographic characteristics would differentiate class membership. We expected that being female, older, a minority race, and uninsured would be more common in the poorest HRQoL class. Additionally, we hypothesized that past month income would be lowest and lifetime months homeless would be highest among the poorest HRQoL class.

Hypothesis 3: smoking characteristics, including an index of smoking heaviness and years smoking, would differentiate class membership such that the index of smoking heaviness and years smoked would be greatest in the poorest HRQoL class.

Hypothesis 4: informed by extant research focused on risk and protective factors and health,[50,51] anxiety sensitivity, stress, and social support would differentiate class membership. Specifically, we hypothesized that anxiety sensitivity and stress would be highest among those in the poorest HRQoL class and social support would be lowest among this group.

Hypothesis 5: after controlling for univariate factors that differ across classes, greater anxiety sensitivity, greater stress, and less social support would emerge as unique correlates of poorer HRQoL class membership.

METHODS

Participants

Data from 456 adult smokers who participated in a larger study about health among homeless adults were utilized in the current study. Participants were recruited via study flyers from six agencies providing services and/or shelter to homeless individuals in the Oklahoma City area. The following were inclusion criteria: (a) minimum age of 18 years, (b) currently receiving services (e.g., food, shelter, counseling) at the targeted shelters, (c) at least a 7th grade English literacy level as indicated by a score of ≥4 on the Rapid Estimate of Adult Literacy in Medicine-Short Form,[52] (d) currently smoking, and (e) currently homelessness.

Procedures

Participants provided informed consent and completed questionnaires via a tablet computer whereby survey items were visible on the screen and read aloud using Questionnaire Development System software, version 3.0 (Nova Research, Silver Springs, MD). Data collection occurred at each respective recruitment site in July/August 2016. Participants were compensated with a $20 department gift card for their participation. This study was approved by the Institutional Review Boards at the University of Oklahoma and the University Health Services Center of Houston.

Measures

Independent Variables

Sociodemographics: Sex (0 = male, 1 = female), age (years), race (0 = Non-Hispanic White, 1 = Non-White), education (0 = No formal schooling to 20 = Post-graduate degree), health insurance status (0 = no health insurance, 1 = health insurance coverage), past month total income, and lifetime months homeless were assessed.

Smoking Characteristics: Smoking characteristics included self-reported average cigarettes per day (CPD) and time to the first cigarette of the day after waking, which were summed to derive the heaviness of smoking index (HSI[53]). Self-reported years of smoking was also measured.

Anxiety Sensitivity: The Anxiety Sensitivity Index-3 (ASI-3), derived, in part, from 16-item ASI,[54] is an 18-item self-report measure of the sensitivity to and fear of the potential negative consequences of anxiety-related symptoms and sensations.[55] Respondents are asked to indicate on a 5-point Likert-type scale (0 = “very little” to 4 = “very much”) the degree to which they are concerned about these possible negative consequences. The ASI-3 has sound psychometric properties, including excellent internal consistency, predictive validity, and reliability among smokers.[56] In the present study, the ASI-3 had excellent internal consistency (α = .95).

Stress: The Urban Life Stress Scale (ULSS) is a 21-item scale that assesses subjective contextual community-level stressors by measuring the level of stress associated with various aspects of life.[57] Participants are asked to respond to each item on a 5-point Likert-type scale (1 = “extreme stress” to 5 = “no stress”). The total score reflects the level of stress associated with day-to-day life in an urban environment. The scale’s reliability and validity have been established,[58] and it has been used previously among individuals who were homeless.[26,29,59] In the present study, the ULSS total score demonstrated excellent internal consistency (α = .91).

Social Support: The Interpersonal Support Evaluation List (ISEL-12) is a 12-item self-report measure of the perceived availability of social support.[60] Participants are asked to respond to each item on a 4-point Likert-type scale (1 = “ definitely false” to 4 = “definitely true”). The total score reflects the level of perceived social support, with higher scores representing greater perceived support. The ISEL-12 has been used previously among samples of individuals who were homeless.[29] The ISEL-12 total score demonstrated excellent internal consistency in the current study sample (α = .89).

Dependent Variables

Health-Related Quality of Life—Items to assess health related quality of life (HRQoL) were drawn from the Behavioral Risk Factor Surveillance System survey.[61] Items assessed (1) self-rated health, (2) poor physical health days, (3) poor mental health days, and (4) activity limited days due to poor physical or mental health; items 2-4 are collectively referred to as ‘days’. Self-rated health was assessed with a single item with which participants rated their health on a 5-point scale (1 = “excellent” to 5 = “poor”). This item

has been shown to prospectively predict mortality across multiple studies.[4] The number of poor physical health days during the past month was assessed with the question: "*Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?*". The number of poor mental health days during the past month was assessed by: "*Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?*". Lastly, participants reported the number of days in the previous 30 days in which poor physical or mental health limited their ability to perform usual activities. These items have demonstrated excellent to moderate retest reliability[62] and have been used previously among a sample of smokers who were homeless.[28,40] 'Days' items were categorized as 1 = 0 poor mental/poor/limited activity days, 2 = 0-13 poor mental/poor/limited activity days, and 3 = 14 or more poor mental/poor/limited activity days, as informed by previous work.[63]

Statistical Analysis

Outliers were examined and replaced with the largest observed non-outlier data value.[64,65] Variables included in the LCA to identify classes of HRQoL among homeless smokers were self-rated health, number of days of poor mental health in the past 30 days, number of days of poor physical health in past 30 days, and number of limited activity days due to poor mental or physical health. We performed a series of models with each specifying between one and four classes. Theoretical and statistical considerations (i.e., goodness-of-fit indices) were used to identify the most parsimonious number of profiles that appropriately fit the observed data.[66] Models were compared across classes using the Akaike Information Criterion (AIC),[67] Bayesian Information Criterion (BIC),[68] the sample-size adjusted BIC (aBIC),[69] the Lo-Mendell-Rubin likelihood ratio test (LMR-LRT),[70] and the bootstrap likelihood ratio test (BLRT).[71,72] Comparing across models, lower AIC, BIC, and aBIC values indicate better model fit, and significant LMR-LRT and BLRT values indicate that the model currently assessed provides significantly better fit than a model with one less class. The BIC and BLRT have demonstrated the greatest accuracy in simulation studies,[73,74] and therefore, were given the most weight in model selection. Entropy is also provided as an indicator of how well the model identified disparate classes.[75] Entropy values range from 0 to 1, with higher values indicating greater class separation.[76,77] Full-information maximum likelihood was employed to accommodate missing data; one participant was deleted due to missing data on all four indicators of latent class.

Next, the Bolck, Croon, and Hagenaars[78] technique was employed to examine differences in study variables across classes.[79] Variables that significantly differed across classes were then evaluated in a multiple multinominal regression model. Specifically, the Asparouhov and Muthén's[79] three-step approach was employed to test simultaneous correlates of class membership in a multinomial logistic regression model. The odds ratio (OR) for likelihood of group membership relative to the reference group are presented along with 95% confidence intervals (CI) around the estimate. Individuals with missing data on any of the covariates (n = 8) were excluded from the multinomial regression analyses.

RESULTS

Participant Demographics

Most participants were non-Hispanic White (59.6%) and male (65.1%) with an average age of 43.2 years (*SD* = 11.8). See Table 1 for participant characteristics.

Latent Class Analysis

Fit indices for one- through four-class models are provided in Table 2. Relative to the one-class solution (Class 1: N = 456), two-class solution (Class 1: N = 180; Class 2: N = 276), and four-class solution (Class 1: N = 130; Class 2: N = 153; Class 3: N = 46; Class 4: N = 127), the three-class solution (Class 1: N = 172; Class 2: N = 156; Class 3: N = 128) demonstrated superior fit as evidenced by a lower AIC, lower BIC, and lower aBIC. Additionally, the LMR-LRT and BLRT both supported the three-class solution over other class solutions. Based on these goodness-of-fit indices, the three-class solution was determined to be the most parsimonious, best fitting solution.

Figure 1 presents the corresponding class plot. Class 1 includes smokers with the greatest probability of reporting their health as very good or good and zero poor health days across the 'days' items. Class 2 is characterized by smokers with the greatest probability of reporting their health as good or fair and 1-13 poor health days across the 'days' items. Class 3 comprises smokers with the greatest probability of reporting their health as fair or poor and at least 14 poor health days across the 'days' items. The three classes were labeled excellent HRQoL (Class 1), moderate HRQoL (Class 2), and poor HRQoL (Class 3).

Differences in Across Class Membership

Women were more likely to report poor HRQoL relative to excellent HRQoL. Relative to smokers with excellent or moderate HRQoL, those with poor HRQoL were older, smoked more CPD, smoked for more years, had higher scores on the HSI, ASI-3 and ULSS, and lower scores on the ISEL-12. Lastly, compared to smokers with excellent HRQoL, smokers with moderate HRQoL had higher ASI-3 and ULSS scores, and lower ratings on the ISEL-12. See Table 1.

Multinomial Logistic Regression for Class Membership

Variables that were included as potential factors related to HRQoL class membership included sex, age, lifetime months homeless, HSI, ASI-3, ULSS, and ISEL-12. Conceptually, years smoked is confounded by age, as the two variables were highly correlated ($r = .67$, $p < .001$); therefore, years smoked was omitted from the current regression model.

Findings revealed that older smokers who reported higher anxiety sensitivity[1] and stress and lower social support were significantly more likely to be in the poor HRQoL group relative to the excellent HRQoL group (age: OR = 1.07, 95% CI [1.04, 1.1]; ASI-3: OR = 1.04, 95%

[1]In post-hoc analyses with the ASI-3 subscales, only the ASI-3 Cognitive subscale differentiated class membership between the poor and excellent HRQoL classes and the moderate and excellent HRQoL classes in the multinomial regression model.

CI [1.01, 1.07]; ULSS: OR = 1.10, 95% CI [1.06, 1.14]; ISEL-12: OR = 0.95, 95% CI [0.91, 0.99]). Consistent with this pattern of findings, older smokers with higher stress and less social support were significantly more likely to be in the poor HRQoL class relative to the moderate HRQoL class (age: OR = 1.04, 95% CI [1.01, 1.07]; ULSS: OR = 1.03, 95% CI [1.01, 1.06]; ISEL-12: OR = 0.96, 95% CI [0.93, 1]). Lastly, smokers who reported higher anxiety sensitivity and stress were more likely to be in the moderate HRQoL group relative to the excellent HRQoL group (ASI-3: OR = 1.03, 95% CI [1, 1.06]; ULSS: OR = 1.07, 95% CI [1.03, 1.11]).

DISCUSSION

The current study evaluated HRQoL subgroups across homeless adult smokers. Three unique classes of HRQoL emerged. The first class (excellent HRQoL) was characterized by better self-rated health and fewer ‘days’ of poor health over the past 30 days. The second class (moderate HRQoL) was characterized by moderate self-rated health and slight elevations in poor health ‘days’. Lastly, the third class (poor HRQoL) was characterized by the poorest self-rated health and greatest number of poor health ‘days’ in the past month. Perhaps not surprisingly given the vulnerability of this underserved group,[11,12] poor HRQoL characterized more than a quarter of this homeless sample. The present study also identified unique correlates of poorer HRQoL class membership. Specifically, older smokers with greater emotional distress, as evidenced by greater anxiety sensitivity, greater stress, and less social support, may be particularly vulnerable to poorer HRQoL. Thus, results provide preliminary evidence for HRQoL classes and factors related to these classes among a vulnerable, understudied group, i.e., adult smokers who were homeless.

Current findings further substantiate the latent construct underlying the four-item CDC HRQoL measure.[80] Indeed, the present results suggest that the degree of perceived health quality traverses multiple HRQoL domains uniformly. Yet, prior to the present investigation, the synchronized movement of self-rated health and health ‘days’ had not been investigated in a latent class model or among homeless adult smokers. The unique statistical approach employed to study ratings of self-rated health and health ‘days’ among homeless smokers advances current understandings for how these domains relate. Additionally, current findings provide evidence that the observed latent classes, which appear to directly parallel the underlying latent HRQoL construct, are applicable to vulnerable samples.

Select sociodemographic constructs differed across class. Disproportionately more women were classified in the poor HRQoL class relative to the excellent HRQoL class. Past work suggests that women tend to report poorer HRQoL than men.[31] Adding to the growing research on sex inequalities for HRQoL across vulnerable populations,[81–83] this is the first study to test this pattern in a sample of homeless smokers. Additionally, a greater proportion of older smokers were observed in the poor HRQoL class relative to the moderate or excellent HRQoL class. This finding provides a novel interpretation for the impact of age on HRQoL among homeless smokers. Specifically, whereas older homeless smokers tended to be classified as having poor HRQoL, younger homeless smokers did not differ in their response patterns of HRQoL as evidenced by a statistically equivalent mean age across excellent and moderate HRQoL classes. Beyond sex and age, the three classes did not differ

on any other sociodemographic variable (e.g., race, education, health insurance status, past month total income, and total months homeless in lifetime). Nevertheless, the current findings identified unique sociodemographic variables that may serve as risk correlates for poorer HRQoL among homeless smokers.

Years smoked and heaviness of smoking both differed across class, such that homeless smokers in the poor HRQoL class reported significantly more years smoking and a higher heaviness of smoking index relative to the other groups. Extensive work has linked indicators of more severe smoking behaviors (i.e., years smoked, cigarettes per day, quit history)[84–86] and poorer HRQoL. The current work extends these findings to homeless smokers. Additional work should examine these relations across other vulnerable subgroups of smokers likely to experience health disparities, including smokers with serious and persistent mental illness.[87]

A tiered pattern of findings emerged regarding anxiety sensitivity, stress, and social support. Specifically, smokers in the excellent HRQoL class exhibited the lowest endorsement of anxiety sensitivity and stress and most social support, followed by smokers in the moderate HRQoL class and then smokers in the poor HRQoL class, who reported the highest anxiety sensitivity and stress and the least social support. Moreover, beyond age, these constructs emerged as the only significant factors associated with class membership in the multinomial regression model. Thus, the current investigation provides evidence that psychological protective and risk factors of physical health, including anxiety sensitivity, stress, and social support,[35,50,51] may also be pertinent to subjective measures of health, like HRQoL.

Based on the present data, it may be advisable for researchers and clinicians to employ the four-item CDC HRQoL measure over lengthier, more arduous HRQoL measures. Indeed, this measure provides a quick assessment of HRQoL that clinicians can use to identify patients at greatest risk for overall poorer HRQoL. Importantly, the identification of heterogeneous subgroups for HRQoL across the four-item CDC measure is consistent with what has been found with lengthier HRQoL measures. Thus, the present findings contribute uniquely to the growing evidence for the need to examine heterogeneity in responding to HRQoL items.

Limitations

There are several limitations that should be noted. The study focused on homeless adult smokers from a single southern metropolitan area receiving services at homeless-serving agencies; therefore, results may not extend to homeless adults from other areas of the country or homeless adults who choose not to or are not able to receive services. Additionally, the cross-sectional nature of the current work limits its generalizability to patterns that may emerge over time. As an important ‘next step’ in this line of inquiry, future work should focus on examining patterns of HRQoL among homeless smokers over time as well as how response patterns and potentially even class groupings might change as a result of quitting smoking or successfully addressing the psychological factors that play into class membership with intervention. Indeed, associations between smoking and HRQoL are likely to be bidirectional given strong associations between negative affectivity and smoking. While lower HRQoL may be a cause and consequence of smoking, the high proportion of

homeless smokers who want to quit[18] suggests intervention efforts incorporating attention to psychological constructs affecting HRQoL are likely to be fruitful regardless of temporal direction.

Public Health Implications

Current findings contribute to the public health effort to elucidate potential protective and risk correlates of HRQoL and offer attention to an underserved and under-studied group that experiences significant health disparities. Findings underscore the need to screen for HRQoL and its correlates. Screening for factors that related to HRQoL such as age, psychological distress, and social support may help practitioners and clinicians develop more appropriate treatment plans to improve lower HRQoL. Additionally, to further promote health, homeless or transitional-housing shelters may consider developing support or recreational groups to increase perceived social support. This effort may be particularly important considering that availability of social support appears to play an important role in health-related outcomes among homeless adults.[90] Although the current study is limited by its cross-sectional nature, future research would benefit from examining effects of physical and psychological health treatment on HRQoL.

Policy Implications

From a broader policy perspective, one viable avenue to improve HRQoL among homeless smokers may be to develop policies and approaches that align with reducing stress-related experiences. Considering that stress related to poorer HRQoL in the present study, policies and approaches that aim to alleviate stress may facilitate improved HRQoL. As one pointed example, developing smoking free shelter policies would provide a healthier shelter environment for homeless individuals and also encourage cessation or harm reduction approach to smoking cessation.[91] Over time and with appropriate behavior change, such policies have the potential to positively impact stress related to physical health.

Future Research

Future work should continue to explore unique risk and protective factors of HRQoL within a latent class framework, as this may provide parsimonious and accurate information for correlates of HRQoL groups. Additionally, it may be advisable for future work to examine typology of psychological factors, including anxiety sensitivity, stress, and social support, and its relation to HRQoL. Such work, if consistent with the presently presented findings, would further validate the current work and offer an additional perspective for the interplay between HRQoL and psychological risk and protective factors for perceived health. Finally, an expansion to the behavioral correlates of HRQoL and examination of how latent classes that underpin such behavioral correlates relate to HRQoL is indicated. Indeed, such would clarify how objective severity of health behaviors, such as severity of smoking, relates to perceived health.

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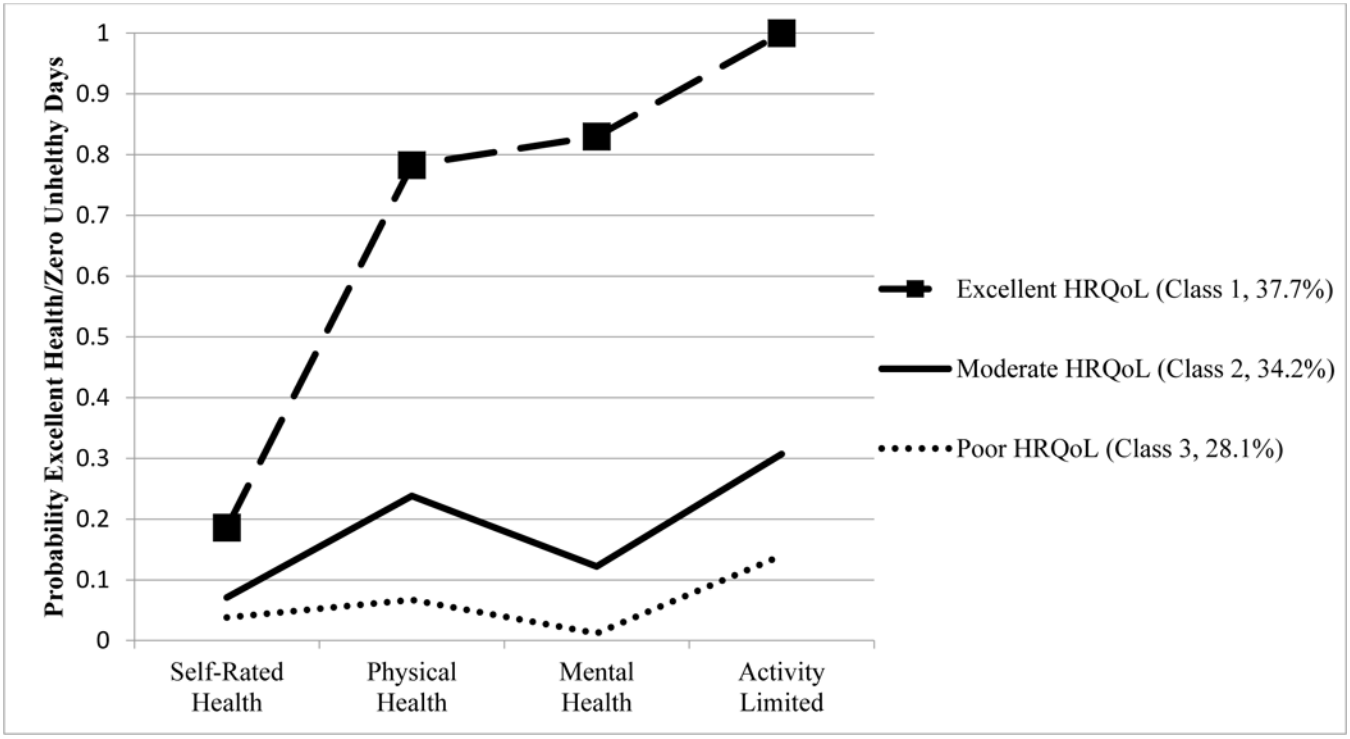

Figure 1. Latent profiles using CDC HRQoL (*n* = 456)

The figure displays comparisons for the latent profiles using the CDC HRQoL measure. Excellent HQRoL class, 37.7% of sample, demonstrated the highest probability of excellent health/zero unhealthy days. Moderate HRQoL class, 34.2% of the sample, demonstrated a lower probability of excellent health/zero unhealthy days that those in the excellent HRQoL class. Finally, the poor HRQoL class, 28.1% of the sample, demonstrated the lowest probaiblity of excellent health/zero unhealthy days.

Table 1

Descriptive statistics and LCA three-class solution comparisons.

Variable	Overall	Excellent HRQoL (Class 1)	Moderate HRQoL (Class 2)	Poor HRQoL (Class 3)	Class Comparisons (chi-square value)		
					1 vs 2	2 vs 3	1 vs 3
Sex, n female [%]	159 [34.9]	48 [27.9]	60 [38.5]	51 [39.8]	3.68	0.04	5.00*
Age, M (SE)	43.18 (0.56)	40.12 (1.07)	42.92 (1.07)	47.08 (0.98)	2.97	7.26**	22.97***
Race, n White [%]	272 [59.6]	100 [58.1]	95 [60.9]	77 [60.2]	0.25	0.02	0.14
Education, M (SE)	11.76 (0.09)	11.80 (0.18)	11.61 (0.17)	11.91 (0.19)	0.5	1.17	0.17
Health Insurance Status, n insured [%]	138 [30.3]	42 [24.4]	53 [34.0]	43 [33.6]	3.32	0.01	3.26
Past Month Income, M (SE)	323.32 (20.49)	310.70 (36.68)	306.63 (42.61)	357.78 (39.45)	0.01	0.68	0.76
Lifetime Months Homeless, M (SE)	38.28 (1.76)	36.16 (3.28)	36.65 (3.12)	42.71 (3.85)	0.01	1.31	1.68
Years Smoked, M (SE)	22.62 (0.60)	20.25 (1.05)	21.01 (1.15)	27.31 (1.21)	0.21	12.51***	19.40***
Heaviness of Smoking Index, M (SE)	2.81 (0.07)	2.63 (0.14)	2.69 (0.15)	3.17 (0.13)	0.08	5.16*	8.10**
ASI-3, M (SE)	24.75 (0.84)	15.48 (1.27)	26.51 (1.64)	33.43 (1.67)	24.17***	7.68**	73.54***
ULSS, M (SE)	49.38 (0.70)	40.02 (1.13)	50.95 (1.21)	58.43 (1.34)	37.95***	15.08***	110.64***
ISEL-12, M (SE)	32.75 (0.41)	35.98 (0.74)	33.07 (0.75)	28.59 (0.78)	6.66**	15.06***	47.07***

Note.

*
p<.05,

**
p<.01,

***
p<.001.

Chi-square degrees of freedom = 2. M (SE) = Mean (Standard Error); Means and standard errors reported for all variables except sex, race, and health insurance status; frequency and percentage for female, White, and health insurance presented for sex (0 = male, 1 = female), race (0 = Non-White, 1 = White) and health insurance status (0 = no health insurance, 1 = health insurance coverage), respectively.

ASI-3: Anxiety Sensitivity Index-3[55]; ULSS: Urban Life Stress Scale[57]; ISEL-12 Interpersonal Support Evaluation List – 12.[60]

Table 2

Fit statistics for latent class models of CDC HRQoL items.

Model	AIC	BIC	aBIC	LMR-LRT	BLRT	Entropy
1 Class	4315.79	4357.01	4325.28	–	–	–
2 Class	3934.82	4021.39	3954.74	397.08*	402.97*[a]	0.76
3 Class	**3807.96**	**3939.88**	**3838.32**	**146.47***	**148.86***	**0.77**
4 Class	3809.36	3986.63	3850.16	20.29	20.59	0.77

Note.

N = 456;

*p<.01.

Bold indicates the best fitting latent class model.

CDC HRQoL = Health-Related Quality of Life[61]; AIC: Akaike Information Criterion[67]; BIC: Bayesian Information Criterion[68]; aBIC: Sample-size adjusted BIC[69]; LMR-LRT: Lo-Mendell-Rubin likelihood ratio test[70]; BLRT: Bootstrap likelihood ratio test.[71,72]

[a]Significance of BLRT may not be reliable because bootstrap draws did not converge.