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Cross-sectional study on stigma and motivation to adhere to lifestyle modification among vulnerable populations with fatty liver disease

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Abstract

Objectives: Adherence to lifestyle modification (diet, exercise, and alcohol cessation) for fatty liver disease (FLD) management remains challenging. The study examined stigma, barriers, and factors associated with motivation to adhere to lifestyle modification in a diverse and vulnerable population with FLD.

Methods: From 2/19/2020 to 2/28/2022, 249 FLD patients within San Francisco safety-net hepatology clinics were surveyed along with clinical data taken from medical records. Multivariable modeling assessed factors associated with motivation to adhere to lifestyle modification in a cross-sectional study.

Results: Median age was 53 years, 59% female, 59% Hispanic, 25% Asian/Pacific Islander, 9% White, and 2% Black, 79% were non-English speakers, 64% had ≤ high school education, and 82% reported <$30,000 annual income. Common comorbidities included hyperlipidemia (47%), hypertension (42%), diabetes (39%), and heavy alcohol use (22%). Majority (78%) reported experiencing stigma, 41% reported extreme motivation, and 58% reported ≥ two barriers. When controlling for age, sex, Hispanic ethnicity, alcohol consumption, BMI, >high school (coef 1.41, 95% CI 0.34–2.48), stigma (coef 0.34, 95% CI 0.07–0.62), and depression (coef −1.52, 95% CI -2.79 to −0.26) were associated with motivation.

Conclusions: Stigma is commonly reported among FLD patients. Interventions to enhance patient education and mental health support are critical to FLD management, especially in vulnerable populations.

KEYWORDS
alcohol-associated liver disease, behavioral modification, metabolic syndrome, NAFLD, underserved populations

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1 | INTRODUCTION

Reflecting the epidemic of obesity, fatty liver disease (FLD) is an emerging chronic condition worldwide, affecting nearly one-quarter of the United States (U.S.) population.[1–4] Fatty liver disease (FLD) is closely linked to obesity and its metabolic consequences, including insulin resistance, type 2 diabetes (T2DM), and dyslipidemia.[2,5] Moreover, FLD can occur within the context of both metabolic abnormalities and alcohol use; these conditions and patient behaviors often co-exist.[6] Racial and ethnic disparities exist in disease burden, severity and progression of disease.[7,8] For example, compared to Hispanics, other racial and ethnic groups have lower prevalence of alcohol-associated liver disease (9.3% vs. 4.1% in White, 3.4% in Black, and 2.7% in other groups).[9] Moreover, a meta-analysis of 10 studies on non-alcohol associated steatohepatitis (NASH), a severe form of FLD, showed highest prevalence among Hispanics (45.4%; 95% CI, 40.7%–50.2%) compared to White (32.2%; 95% CI, 30.7%–33.7%) and Black patients (20.3%; 95% CI, 16.8%–24.2%).[8] Vulnerable populations, largely comprising of minority groups, also have high prevalence of metabolic risk factors and unhealthy alcohol use and are especially at risk for experiencing FLD-related disparities.[1,7,10] As these conditions continue to rise in the U.S., more adults, especially those considered vulnerable, will be affected by FLD and its sequelae including hepatocellular carcinoma and cirrhosis with the need for liver transplant.[5,11]

Lifestyle modification through improved diet, physical activity and alcohol cessation is the primary treatment approach for FLD.[6,12,13] Although trials with oral agents are underway, there are currently no approved biomedical treatments for this chronic condition.[14,15] Interventions focused on weight reduction among FLD patients have shown reduction in liver fat accumulation or fibrosis regression.[15–18] Cohort studies on bariatric surgery have reported favorable decrease in hepatic fat content among patients with obesity and NASH.[19–21] Other weight management interventions have shown modest reductions in liver tests but these are non-specific outcomes.[22,23] Similarly, alcohol cessation has been associated with improvements in FLD, though challenges exist in the sustainability of these habits in the long term.[24]

While optimal behavior change is the foundation for FLD care, patient practices can be influenced by stigma, inequities in access, and other barriers. Conceptual models have explored internal stigma as personal feelings of judgment leading to shame while external stigma represents the perception of being blamed by society for having the condition that is negatively perceived.[25] National clinical guidelines state the potential negative impact of stigma on disease management for patients with hepatitis B/C, alcohol use, and NAFLD.[6] In ways similar to obesity, FLD may be regarded as a self-inflicted disease and, at the same time, its current nomenclature may carry stigma that is being reconsidered by various societies.[26–28] Though stigma has been evaluated in studies on diabetes,[29] obesity,[28,30] and alcohol use disorder,[31] it has not been studied extensively in FLD.[32–34] Research has also suggested demand for convenience, an obesogenic environment, and health literacy as barriers to adherence of nutrition-related FLD recommendations.[35,36] In addition, social determinants of health (SDoH), including access to affordable healthy foods[37] and safe spaces for physical activity,[38] may contribute to limited adherence to lifestyle modification. Awareness of stigma and barriers may assist in generating an approach to more effective risk stratification and targeted interventions to address patients' needs.

Since lifestyle modification remains the cornerstone of FLD care, the study aims to: (1) describe motivation, perceived stigma, and barriers to lifestyle modification among a diverse and vulnerable population with FLD, and (2) examine factors associated with motivation to adhere to lifestyle modification for managing FLD.

2 | METHODS

Study participants. From 19 February 2020 to 28 February 2022, the study recruited adult patients 18 years or older receiving care at hepatology clinics at the Zuckerberg San Francisco General Hospital, a safety-net hospital serving vulnerable populations in the San Francisco county. Participants diagnosed with FLD, defined as the presence of steatosis on liver biopsy or imaging (e.g., liver ultrasound, MRI/CT abdomen and pelvis) from either non-alcohol (metabolic-associated) and/or alcohol-associated etiologies were included. Adults with medical or psychiatric comorbidities preventing study participation or those unwilling or unable to provide consent were excluded. All participants with a hepatology appointment were screened for study participation through medical record review and those eligible were approached either via phone call or in person at or after their visit. As part of a larger research program aimed at examining FLD-associated biometric factors with race/ethnicity and changes in patient knowledge after an educational intervention (R.G. K, M.K.), the estimated sample size for the program was 196 patients, which included alpha (two-tailed) set at 0.05, 80% power (beta 0.2), effect size 0.2, and standard deviation of 1. To account for attrition in survey data collection or the educational intervention, the goal was to enroll 250 patients. The study was approved by the Institutional Review Boards of the University of California, San Francisco and Zuckerberg San Francisco General Hospital.

Data collection and survey design. Electronic medical records were used to collect clinical data. Sociodemographic data, including self-identified race/ethnicity and primary language, and social data were collected directly from participants. Current and past tobacco use was captured. Alcohol use in the prior 12 months was assessed using the National Institute of Alcohol Abuse and Alcoholism (NIAAA) questionnaire.[39] The survey instrument was designed using the Health Behavior Framework,[40] a socioecological model on factors influencing behaviors, with input from behavioral scientists and hepatologists experienced in behavior change research, liver disease and substance use disorders.[40,41] The survey (Supplement 1) was organized into four domains: (1) perceptions of medical care, (2) barriers to FLD management and lifestyle modification, (3) perceived stigma, and (4) motivation to adhere to lifestyle modification. The

study utilized a 6-item stigma score that included internal and external domains of perceived stigma with the highest total score being 30. A Likert scale ("strongly agree" to "strongly disagree", five options) was used for each of the 6 stigma items. A 4-item score on motivation to adhere to lifestyle modification (maximum score of 16) was used, which included the Likert scale from "Not motivated at all" to "Extremely motivated" (4 options). The number of perceived barriers in following provider recommendations regarding healthy eating and exercise (up to 21) were also used. The survey was developed in English and translated to Spanish, the most preferred non-English language among participants. Certified medical interpreters were involved in data collection. Cronbach's coefficient alpha was used to assess the internal consistency across items within the stigma score and motivation score. The survey was pre-tested among a diverse group of adults with FLD at the study site and modified prior to data collection. Participants received a $25 gift card after study completion.

Data analysis. A conceptual framework was designed to capture personal, interpersonal and system-level factors associated with motivation to adhere to lifestyle modification (Figure 1). This study framework draws from the National Institute on Minority Health and Health Disparities (NIMHD) research framework, which emphasizes an ecological model in understanding health outcomes from individual to societal levels.[42] This framework was used to identify a priori significant predictors associated with the primary outcome of motivation to adhere to lifestyle modification. Stigma and barriers were selected as the primary predictors of interest. Descriptive analysis of participant characteristics included median and interquartile range (IQR) for continuous variables and frequency for categorical variables. See Supplement 1 for clinical data definitions.[43,44]

Survey responses were summarized using frequencies and percentages. Composite scores for perceived stigma (max score 30) and motivation to adhere to lifestyle recommendations (max score 16) were calculated, respectively. Barriers to lifestyle modification adherence were assessed by the number of reported barriers. Univariable and multivariable generalized linear models were used to assess factors associated with motivation to adhere to lifestyle modification. Predictors included those selected a priori as follows: age, sex, race/ethnicity, language preference and English fluency, SDoH including education, income, employment, and household size, BMI, alcohol consumption, and medical and psychiatric comorbidities. For the variable annual household income that had more than 10% data designated as missing or participant declined to answer, a missing category was created to determine if there was an influence on the relationship between this predictor and the outcome. The multivariable model adjusted for age, sex, race/ethnicity, BMI, and alcohol consumption, and included stigma and barrier scores as well as predictors with $p < 0.05$ on univariable analysis. As Hispanic ethnicity comprised the largest racial/ethnic group in this study, race/ethnicity was categorized as Hispanic versus non-Hispanic in the primary multivariable model. The model was also repeated with all racial categories using White as the reference group. Statistical significance was considered as $p < 0.05$ (two-sided) in all models. Analysis was performed using Stata 16 software (Stata Corp LP, College Station, TX, USA). All authors had access to the study data and reviewed and approved the final manuscript.

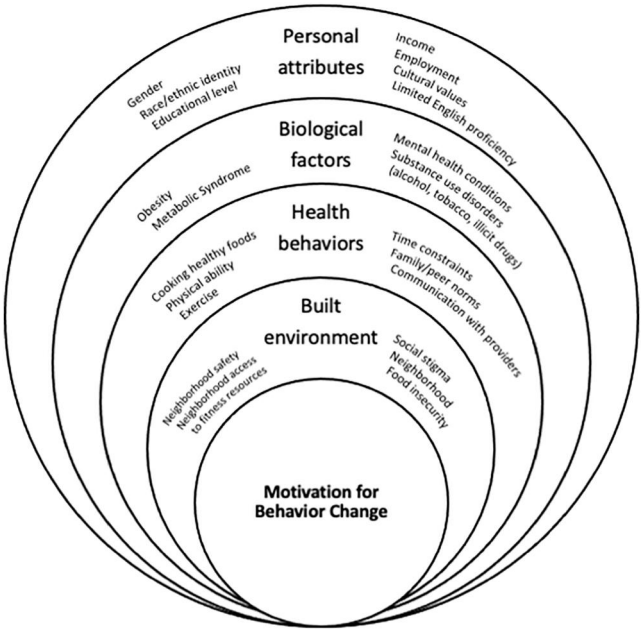

FIGURE 1 The figure depicts an ecological perspective that includes personal (e.g., attributes and biological factors), interpersonal and system-level factors (e.g., built environment) associated with personal motivation to adhere to lifestyle modification.

3 | RESULTS

Patient characteristics. Three hundred and thirty-one eligible participants were approached and two-thirds (n = 249) participated in the survey study (Figure 2). Table 1 summarizes patient characteristics. The median age was 53 years with 59% reporting female sex. Racial/ethnic groups represented in this study included 59% Hispanic, 25% Asian or Pacific Islander, 9% White, and 2% Black. For 79% of participants, English was not their primary language, though

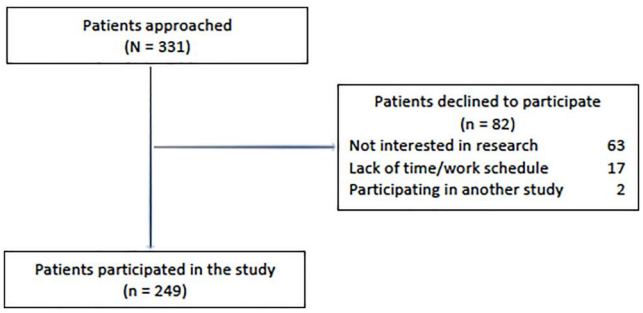

FIGURE 2 The flow diagram showcases the number of patients approached and the number of patients who consented and participated in the study.

TABLE 1 Patient characteristics (n = 249).[a]

Characteristic	All participants
Median age, (IQR), years	53 (43–63)
Sex, *n* (%)	
Female	147 (59)
Male	102 (41)
Race/ethnicity, *n* (%)	
White	22 (9)
Black	5 (2)
Hispanic	147 (59)
Asian/Pacific islander	63 (25)
Other/Multi-racial/ethnic	12 (5)
English Fluency, *n* (%)	(*n* = 244)
Fluent in English	167 (68)
Not fluent in English	77 (32)
Primary language non-English, *n* (%)	197 (79)
Education level, *n* (%)	(*n* = 239)
High school or less	152 (64)
More than high school	87 (36)
Employment status, *n* (%)	(*n* = 241)
Employed	82 (34)
Unemployed	94 (39)
Retired	65 (27)
Annual household income, *n* (%)	(*n* = 197)
Less than $30,000	161 (82)
$30,000 or more	36 (18)
Household size, *n* (%)	(*n* = 242)
Less than 3 members	109 (45)
3–5 members	102 (42)
More than 5 members	31 (13)
Alcohol consumption in last 12 months, *n* (%)	
None	163 (66)
Minimal/moderate	31 (12)
Heavy	55 (22)
Tobacco use, *n* (%)	
None	171 (69)
Past	57 (23)
Current	21 (8)
BMI[b]	
Underweight/Normal	29 (10)
Overweight	76 (31)
Obesity	148 (59)
Hyperlipidemia, *n* (%)	118 (47)
Hypertension, *n* (%)	105 (42)
Diabetes, *n* (%)	98 (39)
Depression, *n* (%)	52 (21)
Anxiety, *n* (%)	16 (6)
Median barrier score, (IQR), *n* = 243	2 (1–4)
Median stigma score, (IQR), *n* = 243	2 (1–4)
Median motivation score, (IQR)	14 (12–16)

[a]Unless otherwise specified in table.

[b]BMI, body mass index, was calculated based on WHO standards for race-based categories: normal weight <25 kg/m^2 (<23 kg/m^2 for API), overweight 25–29 kg/m^2 (23–27.4 kg/m^2 for API), and obesity >30 kg/m^2 (≥27.5 kg/m^2 for API).

68% reported English fluency. Nearly two-thirds (64%) completed a high school education or less. Two-thirds of the participants reported being unemployed or retired and 82% reported an annual income of less than $30,000. Approximately half (55%) of the participants lived in households with 3 or more members. Metabolic risk factors (hyperlipidemia, hypertension, T2DM) were common and median BMI was 30 kg/m^2. Alcohol consumption in the last 12 months was prevalent at minimal/moderate and heavy levels among 12% and 22% of participants, respectively, while the remaining participants (66%) reported no alcohol use.

Stigma and barriers to lifestyle modification. Cronbach's coefficient alpha for the stigma score used in the survey yielded an acceptable internal reliability coefficient of 0.77, while the motivation score yielded a coefficient of 0.81. The median score for perceived stigma was 2 (IQR 1–4). Although 22% did not report any stigma, the majority (78%) reported at least one stigma factor and 65% reported two or more stigma factors. The median score for barriers was 2. Approximately 20% of patients did not report any barriers to adhering to lifestyle modification. However, over half (58%) reported two or more barriers. The most common barriers were "not feeling motivated" (27%), not knowing "the best way to exercise" (24%), "cost of healthy foods" (20%), and not knowing "how to cook healthy foods" (19%). The least common barriers were the lack of belief that "a healthy diet and exercise are important" (2%) and not being informed by a physician "to eat healthier or exercise more" (3%). The median motivation score was 14 (IQR 12–16). While very few participants (4%) reported minimal motivation, 41% reported extreme motivation.

Factors associated with motivation to adhere to lifestyle modification. On univariable analysis (Table 2), higher education (coef 1.28, 95% CI 0.26–2.31, p = 0.01) was positively associated with higher motivation to adhere to lifestyle recommendations. Depression was negatively associated with motivation (coef −1.55, 95% CI -2.72 to −0.38, p = 0.01). Although not statistically significant,

TABLE 2 Univariable model of factors associated with motivation to adhere to lifestyle modification (n = 249).[a]

Characteristic	Coef	95% Confidence interval		p-value[b]
Age	−0.03	−0.06	0.01	0.16
Female sex	−0.72	−1.70	0.26	0.15
Race/ethnicity				
White	Reference			
Black	0.14	−3.64	3.92	0.94
Hispanic	−0.83	−2.58	0.92	0.35
Asian/Pacific islander	−1.51	−3.41	0.38	0.12
Other/Multiracial	0.47	−2.27	3.21	0.74
Hispanic (n = 244)	−0.12	−1.13	0.89	0.80
Not fluent in English (n = 244)	0.72	−0.31	1.76	0.17
Non-English primary language	0.68	−0.51	1.88	0.26
More than high school education (n = 239)	1.28	0.26	2.31	**0.01**
Employed status (n = 241)	−0.18	−1.23	0.87	0.74
Annual household income of $30,000 or more	−0.09	−1.62	1.44	0.91
Household size (n = 242)				
Less than 3 members	Reference			
3–5 members	0.83	−0.21	1.86	0.12
More than 5 members	0.77	−0.76	2.30	0.32
Alcohol consumption in last year				
None	Reference			
Minimal/moderate	0.25	−1.24	1.74	0.74
Heavy	−0.68	−1.87	0.51	0.26
BMI (n = 246)	0.00	−0.07	0.08	0.99
Hyperlipidemia	−0.55	−1.52	0.42	0.27
Hypertension	−0.16	−1.14	0.82	0.75
Diabetes	−0.16	−1.15	0.83	0.75
Depression	−1.55	−2.72	−0.38	**0.01**
Anxiety	−1.95	−3.91	0.001	0.051
Stigma score (n = 243)	0.22	−0.02	0.47	0.07
Barrier score (n = 243)	−0.06	−0.20	0.08	0.43

Abbreviation: BMI, body mass index.

[a]Unless otherwise specified in table.

[b]Bold represents p-value <0.05.

anxiety was associated with lower motivation (coef −1.95, 95% CI −3.91 to 0.001, p = 0.051). When controlling for age, sex, Hispanic ethnicity, alcohol consumption in the last year and BMI, educational level (more than high school, coef 1.41, 95% CI 0.34–2.48, p = 0.01) and stigma score (coef 0.34, 95% CI 0.07–0.62, p = 0.01) were positively associated with motivation to adhere to lifestyle recommendations (Table 3). Depression (coef −1.52, 95% CI −2.79 to −0.26, p = 0.02) remained negatively associated with motivation. When using White race as the reference in the multivariable analysis, estimated coefficients did not change significantly (Supplement 2). The results of the multivariable models were not affected when controlling for other variables, such as diabetes, and other health-related behaviors such as tobacco use, English as a primary language, English fluency, and household size (data not shown).

4 | DISCUSSION

The standard recommendation for FLD care is to adhere to lifestyle modification that includes weight loss, healthy diet, optimal physical activity, and alcohol cessation.[6,12,13] While the effect of behavior

TABLE 3 Multivariable model of factors associated with motivation to adhere to lifestyle modification (n = 226).[a]

Characteristic	Coef	95% Confidence interval		p-value[b]
Age	−0.02	−0.07	0.02	0.25
Female sex	−0.75	−1.86	0.36	0.18
Hispanic (vs. non-hispanic) race/ethnicity	1.00	−0.20	2.21	0.10
Alcohol consumption in the last year (vs. none)				
Minimal/moderate	−0.24	−0.176	1.27	0.76
Heavy	−1.24	−2.52	0.05	0.06
BMI	−0.03	−0.11	0.05	0.47
Depression	−1.52	−2.79	−0.26	**0.02**
More than high school education (vs high school or less)	1.41	0.34	2.48	**0.01**
Stigma score	0.34	0.07	0.62	**0.01**
Barrier score	0.06	−0.20	0.09	0.45

Abbreviation: BMI, body mass index.

[a]Adjusting for age, sex, Hispanic ethnicity, alcohol consumption and BMI.

[b]Bold represents p-value <0.05.

change on FLD has been evaluated extensively,[16–18] to our knowledge, this is the first study to explore perceived barriers, social stigma, and motivation to adhere to lifestyle modification recommendations among a vulnerable population with FLD in the U.S. In this study, common barriers to lifestyle modification included lack of knowledge on how to exercise or cook healthy meals, cost of healthy foods, and lack of motivation to engage in lifestyle modification. In addition, most participants reported experiencing some degree of stigma related to FLD. Importantly, educational level, mental health and perceived stigma significantly impacted motivation to adhere to lifestyle modification.

Prior studies have highlighted the importance of education and other SDoH on health-related behaviors, motivation and ability to succeed with behavior change in diverse populations and more recently in ethnic/racial minorities who face significant health burden from FLD.[8,45] However, there is a paucity of research involving populations that are socioeconomically disadvantaged and represent minority groups with varying levels of English fluency. In this study, higher educational level had a significant influence on patient motivation. Studies have shown that individuals with higher levels of education are more likely to have greater health literacy, a skill to understand and apply health information.[46,47] Public health interventions that aim to increase health literacy surrounding lifestyle modification and access to information may be a critical patient-centered strategy to enhance motivation and consequently behavior change.

Similar to prior studies,[48,49] lack of willpower and knowledge were cited as barriers to lifestyle changes in this population. Of note, participants reported a high degree of motivation and yet, the experience of not having motivation was one of the most cited barriers at 27%. These differences may be related to the fact that the motivation score was a composite score of participants' perceived motivation and contemplation for behavior changes,[50] including improving liver health, achieving target weight, alcohol cessation, and improved diet and exercise, whereas the barrier score was based on patients' experiences of barriers in following provider recommendations regarding healthy eating and exercise. Another important consideration is the cost of healthy meals and minimal access to healthy options in their neighborhoods. Financial incentive interventions to boost motivation and behavior change have not been studied widely though may suggest a future approach toward improving FLD care.[51]

Mental health is another key player with respect to motivation, especially in the management of chronic conditions.[52] Prior studies have shown a relationship between depression and increased alcohol use,[53] decreased physical activity,[54] and worse NAFLD-related histologic findings.[55] Our study suggests that these relationships may occur as a result of the negative impact of depression on motivation to adhere to lifestyle modification. This highlights the importance of treating comorbid depression and enhancing coping mechanisms among patients, especially during and after the COVID-19 pandemic that affected health behaviors in patients with FLD.[56]

Stigma has also been studied extensively in relation to behavior outcomes and health-related quality of life within diabetes, obesity, and alcohol use research.[28–31] Within chronic liver disease research, however, studies on stigma have been limited even though it is considered a barrier to address in the nomenclature and management per clinical guidelines.[6,13] In a recent European study on stigma among patients with FLD, a high proportion of patients reported stigma in the form of stereotypes, discrimination and shame surrounding their disease.[32] Moreover, recent publications on stigma in alcohol-associated liver disease highlighted a common yet understudied reality that patients face in the healthcare setting and its negative effects on help-seeking behavior.[57,58] Although stigma has been associated with weight gain, exercise avoidance, and vulnerability to depression,[28] our study shows that higher levels of perceived stigma related to FLD are associated with higher motivation to adhere to lifestyle modification. The unexpected direction of this relationship may reflect a greater sense of urgency to address FLD

but may not necessarily translate into behavior change or sustained adherence to lifestyle modification. Alternatively, the observed relationship may be related to unmeasured factors. Importantly, in this diverse population, stigma is commonly reported and can encompass perceptions from society and immediate networks of support. These results highlight opportunities for physicians to educate the patient and family on the risks of social stigma and to encourage patients to work toward their goals proactively in a supportive environment. Health systems can design patient-oriented programs that extend beyond health literacy to include psychosocial determinants of health behaviors. More research is warranted on the role of mitigating stigma in behavior change among patients with FLD.

Limitations. The study has limitations. Enrollment of patients attending hepatology clinics may introduce selection bias toward patients with higher motivation levels and may not reflect the views of patients with FLD who lack access or connection to the healthcare system. Also, findings may not be generalizable to other vulnerable populations with FLD given limited sample size. However, the study addresses a knowledge gap on FLD management where adherence to lifestyle modification remains challenging. The survey instrument was not externally validated but assessment of internal consistency of survey items was considered acceptable. Inherent in survey design, recall bias and response bias may affect the reliability of some findings. The findings may be influenced by patients' decision to provide socially desirable responses to staff instead of true perceptions. The findings could have been enriched by qualitative data that explore SDoH and motivation for behavior change. Nevertheless, the study provides valuable information on patient motivation and associated factors in a diverse, socioeconomically disadvantaged population.

5 | CONCLUSIONS

This study showed that most patients with FLD have experienced stigma and perceive barriers to recommended lifestyle modification. This is important in addressing disparities in FLD care among vulnerable populations who face the greatest burden of disease and disease severity. From this study, higher educational level and more perceived stigma are key motivating factors to adhere to lifestyle modification, while poor mental health adversely influences motivation. Targeted interventions to mitigate stigma, barriers and poor mental health may enhance motivation to lifestyle modification but whether this, in turn, translates into behavior change requires further investigation.

AUTHOR CONTRIBUTIONS

Sheyla P. Medina was involved in the conceptualization, formal analysis, investigation, methodology, writing original draft, review and editing. Rebecca G. Kim was involved in the conceptualization, formal analysis, funding acquisition, investigation, methodology, writing original draft, review and editing. Catherine Magee was involved in the conceptualization, formal analysis, funding acquisition, investigation, methodology, and editing/review of manuscript drafts. Noah Stapper was involved in the formal analysis, methodology, and editing/review of manuscript drafts. Mandana Khalili was involved in the conceptualization, formal analysis, funding acquisition, investigation, methodology, project administration, supervision and writing/review of the manuscript.

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CONFLICT OF INTEREST STATEMENT

Sheyla P. Medina, Rebecca G. Kim, Catherine Magee and Noah Stapper do not have any disclosures relevant to this manuscript.

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