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Experienced poverty stigma is associated with food insecurity, mental health, and resource utilization among Southern US mothers with low income

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Abstract

Background The role of poverty stigma, defined as negative stereotyping based on socioeconomic status, in the relationship between food security and mental health has not been well explored. This study aimed to develop and test a theory to explain the role of internalized and experienced poverty stigma in the relationship between food security and mental health among mothers in the Southern US.

Methods A cross-sectional survey was administered in December 2023. The survey was delivered electronically via Qualtrics to mothers living in the southern US who reported a household income below 185% of the federal poverty level. Food security, stigma, and symptoms of anxiety and depression were assessed using previously validated tools. A path analysis was conducted based on the initial conceptual framework and adapted to remove nonsignificant variables. Linear regression was used to assess stigma by resource utilization.

Results Mean poverty stigma scores among mothers ($n = 1{,}008$) were moderate for internalized (3.1 ± 0.8) and experienced stigma (3.1 ± 1.1). Lower food security was associated with higher internalized ($\beta = 0.10$, $p < 0.001$) and experienced stigma ($\beta = 0.34$, $p < 0.001$). Experienced stigma had a small association with both anxiety and depressive symptoms ($\beta = 0.20, 0.23$, $p < 0.001$). Participation in food pantries (+0.17) and the Temporary Assistance for Needy Families (TANF) program (+0.45) was associated with higher experienced stigma ($p < 0.05$).

Conclusions Poverty stigma may be a potential area for intervention to address the relationship between food insecurity and mental health among mothers and improve resource utilization.

Keywords Food security, Poverty stigma, Maternal health, Mental health

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Introduction

Food insecurity and poor mental health are interconnected public health challenges that disproportionately impact mothers [1, 2]. In 2023, the prevalence of food insecurity in the United States (US) was 13.5% of households, which was a significant increase from 12.8% in 2022 [3]. Notably, 34.7% of single female headed households experienced food insecurity compared to 22.6% of single male headed households [3]. There is growing evidence that experiencing food insecurity may be a chronic stressor, especially for mothers, who often manage their household food environment, contributing to multiple mental health concerns like symptoms of depression and anxiety [4–6]. However, chronic food insecurity can contribute to lasting physical and mental health consequences for all household members, including children [4–7]. In the U.S., federal assistance programs like the Supplemental Nutrition Assistance Program (SNAP) and Temporary Assistance for Needy Families (TANF) provide eligible households with monthly benefits via Electronic Benefit Transfer (EBT) cards to purchase food or meet basic needs. In contrast, community-based food pantries typically offer direct food distribution.

Poverty stigma, defined as the societal disapproval of a group based on low socioeconomic status, can be caused by the experience of living in poverty or related to the use of assistance programs to cope with poverty [8–10]. The sociocultural and economic systems in the US contribute greatly to poverty stigma as these systems are steeped in neoliberalism, which emphasizes the role of personal responsibility and self-determination [11]. A corollary of this ideology is a failure to acknowledge the systemic factors that contribute to poverty and minimize the choices a person with limited resources has available [11, 12]. This is especially pressing for mothers as there is immense pressure on mothers to prioritize the needs of their children over their personal needs [12]. Cultural norms may lead some mothers to view using any form of assistance to feed themselves or their families as a personal failure to meet societal expectations, increasing their fear of being seen as a burden or public charge [11, 12].

Poverty stigma can be categorized broadly as internalized or experienced stigma. Internalized stigma is characterized by an expectation of discrimination that manifests as self-discrimination [10]. For example, there is consistent evidence that people may feel internal guilt and shame related to the use of food security coping strategies, such as using food pantries [13–17] and SNAP benefits [18–21]. Experienced stigma is characterized by an encounter with discrimination based on socioeconomic status or perceived need [10], such as being confronted while using resources [16]. Internalized and experienced stigma can co-exist - the experience of feeling or being stigmatized when using such resources may lead to internalization of negative and stigmatizing beliefs about oneself. Broadly, both forms of poverty stigma are associated with social isolation, negative self-evaluation, less usage of assistance programs, depressive symptoms, and suicidal ideation [9, 10, 18]. There is evidence that living with poverty stigma and food insecurity may lead to poor mental health through increased shame and promotion of maladaptive food and mental health coping strategies [18], such as avoidance behaviors resulting in reduced utilization of available resources (e.g., food pantries) [9, 16].

Despite the established significance of poverty stigma in the literature, the role of poverty stigma in the relationship between food security and mental health has not been explicity explored. Understanding key pathways through which poverty stigma acts is essential for understanding the risk process for mothers experiencing food insecurity. These mechanisms of action can be leveraged to design programs that adequately meet the needs of mothers who experience food insecurity and poverty stigma. Therefore, this study aims to identify potential pathways through which internalized and experienced poverty stigma impact the relationship between food insecurity and maternal mental health in the southern US, a region with higher poverty and health disparity levels than other areas of the country [22]. We also aim to understand how stigma is associated with the usage of federal and charitable food assistance programs.

Methods

A cross-sectional survey-based study was conducted in early December 2023 to determine the role of poverty stigma in the relationship between food security and mental health among mothers with low income in the Southern US. This study was deemed exempt by the Oklahoma State University Institutional Review Board. Informed consent was waived by the Oklahoma State University IRB and consent to participate was implied by advancing the survey beyond the information sheet.

Participants

Eligible participants resided in the southern US census region, which covers 16 states from Texas to Delaware and includes the District of Columbia. Participants also had to self-identify as either women or non-binary adults (greater than 18 years of age). Non-binary caregivers were included because they are more likely to take a significant role in managing household responsibilities, including the food environment [23]. Additionally, the participants had to report at least one child under 18 years old residing in their household, though the children were not required to be the biologically related to the respondent.

Finally, reported household income needed to be below 185% of the federal poverty level for their household size. Participants who did not meet the eligibility criteria were excluded from the study. An information sheet was provided before the start of the survey and advancing past the information sheet in the survey implied consent.

Survey administration

The survey was administered through Qualtrics (Provo, UT) to recruit a convenience sample of eligible participants. Qualtrics contacted potential participants through existing survey panels via email listservs and notifications on specific applications. Messaging related to the survey intentionally excluded information about survey topics to reduce selection bias. Participants were compensated by Qualtrics approximately $2–4 in exchange for completing the survey. The exact compensation varied based on the type of incentive the respondent preferred (cash, points, gift cards, sweepstakes entrance, etc.) and the panel with which they were recruited from. To improve data integrity, the panel companies through which Qualtrics recruited verified participant identities prior to joining the panel to mitigate the risk of receiving responses from bots. Additionally, respondents completing the survey in less than half the median time were excluded to account for the potential measurement error that is more likely among samples with online panel participants [24]. A pilot test was conducted with 50 participants before implementing the survey for a larger sample. The pilot study resulted in only minor adjustments in item wording. No personally identifiable information was collected by the research team.

Measures

The survey is available as a supplementary file. Demographic information collected included age, race, ethnicity, household size and structure, income, zip code, education, and participation in nutritional assistance programs in the past year. Participation in nutrition assistance programs over the past 12 months was indicated as yes/no and included programs were: SNAP, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), National School Lunch Program (NSLP), and TANF. A similar item was used to assess food pantry usage over the same time period.

The remainder of the survey was developed using validated measures for all constructs. Household food security status over the previous 12 months was assessed using the 18-item USDA Household Food Security Module [25]. Since all eligible households included one or more children, the total raw score varied from 0 to 18. Scores were categorized as: very low food security (VLFS; 8–18), low food security (LFS; 3–7), marginal food security (MFS; 1–2), and high food security (HFS; 0) according to the USDA guide [25]. Households were also categorized as food secure (HFS, MFS) or food insecure (LFS, VLFS) according to the USDA guide [25]. Mental health was assessed as intervals by measuring clinically significant symptoms of anxiety (GAD-2) and depression (PHQ-2) over the previous two weeks [26, 27]. Both scales are two items with scores ranging from 0 (low) to 6 (high). The threshold for clinical significance on both scales is 3 points. Dichotomous high/low risk for clinically significant symptoms was used to simplify descriptive statistics, but interval scores were used for the path analysis. Poverty stigma over the previous 6 months was assessed with the 8-item Mickelson and Williams measure with two 4-items subscales for internalized and experienced stigma [10]. This measure was selected because it had been previously been used in a sample of women in low income households and showed acceptable reliability [10]. The scale demonstrated acceptable internal consistency in this sample (Cronbach's $\alpha = 0.78$). Each item used a Likert-type scale, with ratings ranging from 1 to 5. An example item was "I feel that others look down on me because of my financial situation." Within each subscale, item scores were averaged together. A higher score indicated greater poverty stigma [10]. Self-reported perceived overall physical health was measured with a single-item tool, with no specific reference period [28]. This tool utilized a Likert-type scale ranging from poor to excellent, with scores ranging from 1 (poor) to 5 (excellent).

Analysis

Data analysis was performed using R version 4.3.1 (R Core Team, Vienna, Austria). Descriptive statistics (mean±SD) were used to summarize demographic variables for the full sample and by food security status. Chi-square and linear regression were used to assess differences by food security status for dichotomous and interval demographic variables, respectively. Effect sizes were calculated using Cramer's V for Chi-square tests. Magnitudes cutoffs were classified as 0.20–0.39 (small), 0.40–0.49 (medium), and >0.50 (large) [29]. Cohen's d was used to calculate effect sizes for t-tests, with cutoffs at >0.3 (small), >0.50 (medium), and >0.80 (large) [30]. Linear regression was used to assess whether experienced and internalized poverty stigma differed by resources utilized (e.g. participation in assistance programs, pantries). The model controlled for food security raw score, household income, and household size.

A path analysis using the "lavaan" package in R was conducted to validate the hypothesized model based on the conceptual framework outlined in Fig. 1. A path analysis can be conducted with cross-sectional data to validate a conceptual framework by determining whether a proposed model is a good fit with the data [31, 32]. This

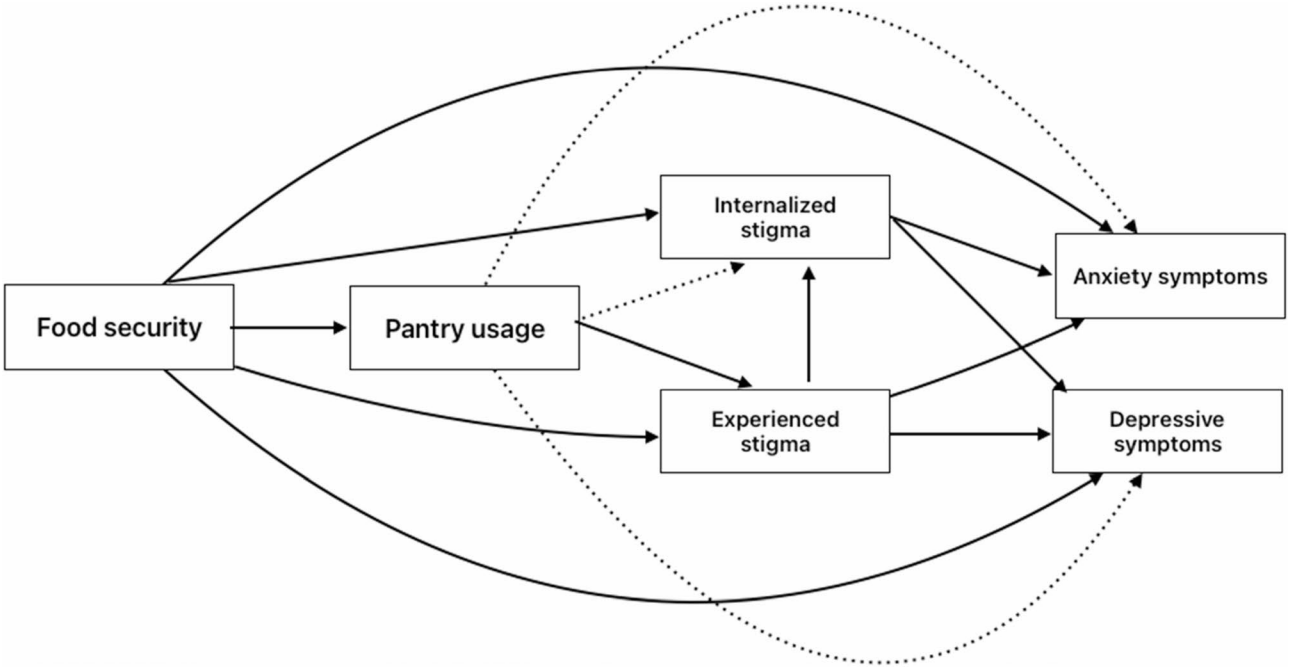

Fig. 1 Conceptual framework of the role of stigma in the relationship between food security and mental health among mothers[1]
1. Dashed lines indicate predicted pathways in the conceptual framework that were not significant and systematically removed from the retained model

model was validated using diagonally weighted least squares, as this is more accurate when the model includes dichotomous variables (i.e. pantry usage) [33]. All other variables were interval, including food security raw scores. The initial model was adapted to systematically remove nonsignificant parameters [34]. Although not depicted in the figure to improve readability, the model did allow for covariance between symptoms of anxiety and depression given the high correlation between these variables. The retained model was intended to provide a framework for further evaluation as this was validated using cross-sectional data.

To assess model fit, we assessed the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Chi-square. Thresholds for good model fit were set at CFI > 0.90, RMSEA < 0.05, and non-significant Chi-square test based on the literature [35]. Estimates, standard errors, and standardized regression coefficients (β) were reported for each parameter included in the model. Additionally, cross-sectional effect size estimates (Cohen's d for interval and ϕ_c for dichotomous) were calculated based on the β and categorized as small (> 0.10), medium (> 0.30), and large (> 0.50) [30]. The significance threshold was set a priori at $p < 0.05$.

Results

Demographic information is presented in Table 1 by food security status. Overall, participants ($n = 1,008$) were 36.1±10.1 years old, on average (range: 18–82). Approximately half of all respondents (52.2%, $n = 526$) identified as white and 37.6% ($n = 379$) identified as Black or African American. Most respondents reported graduating high school (35.6%, $n = 359$) or some college (26.7%, $n = 269$) as their highest educational attainment. Responses were obtained from people in all 16 states of the southern US census region and Washington, DC. Most responses were obtained from Texas (18.7%, $n = 188$) and Florida (14.8%, $n = 149$), with the fewest from Washington, DC (0.4%, $n = 5$) and Delaware (0.7%, $n = 7$). More than one-quarter (26.0%, $n = 262$) of respondents reported being from rural areas, with 37.2% ($n = 375$) from small metro areas and 35.2% ($n = 355$) from large metro areas.

Respondents' household size ranged from 2 to 11, with a mean of 4.0 ± 1.4 including 2.0±1.2 children. More than half of respondents (58.1%, $n = 586$) reported living with a spouse or unmarried partner. Median annual household income was $25,000±15,385 and ranged from $0 to $90,000 (household size of 8). In the past 12 months, more than two-thirds of respondents (69.6%, $n = 702$) reported participating in SNAP and one-third reported they had a child receiving free or reduced-price school meals (33.1%, $n = 334$). Additionally, 23.6% participated in WIC ($n = 238$) and 23.9% reported visiting a food pantry ($n = 241$) in the past year.

Respondents were most likely to perceive their physical health as fair (31.3%, $n = 315$) or good (33.1%, $n = 334$). More than half of respondents (53.1%, $n = 535$) experienced clinically significant symptoms of anxiety over the past two weeks. Additionally, 47.8% of respondents ($n = 482$) experienced clinically significant symptoms

Table 1 Demographic characteristics of survey respondents by food security status[1,2,3]

		HFS (117)	MFS (108)	LFS (218)	VLFS (549)	
Age (in years)		37.3 + 11.4	36.9 + 10.5	34.9 + 9.8	36.2 + 9.8	
Income (USD)		22,851 + 15,352	25,263 + 16,401	24,763 + 14,940	25,532 + 15,341	
Household Size		3.8 + 1.5	4.1 + 1.5	4.0 + 1.4	4.0 + 1.4	
Number of Children		1.9 + 1.3	2.0 + 1.3	1.9 + 1.1	2.0 + 1.1	
Race	Black or African American	47.0 (55)	45.4 (49)	33.5 (73)	32.4 (178)	*
	White	33.3 (39)	45.4 (49)	52.8 (115)	52.6 (289)	
	Other	16.2 (19)	9.3 (10)	12.8 (28)	14.0 (77)	
Education	Less than high school degree	5.1 (6)	6.5 (7)	8.3 (18)	8.9 (49)	
	Graduated high school or GED	44.4 (52)	45.4 (49)	46.8 (102)	40.3 (221)	
	Some college	21.4 (25)	25.0 (27)	21.6 (47)	30.2 (166)	
	Graduated 2-year college	11.1 (13)	13.0 (14)	14.7 (32)	11.8 (65)	
	Graduated 4-year college or higher	19.9 (21)	10.2 (11)	8.3 (18)	8.7 (48)	
Assistance	SNAP	49.6 (58)	68.5 (74)	68.3 (149)	75.2 (413)	*
	WIC	21.4 (25)	18.5 (20)	27.5 (60)	24.0 (132)	
	Pantry	9.4 (11)	13.0 (14)	19.3 (42)	31.1 (171)	*
	NSLP	20.5 (24)	27.8 (30)	33.9 (74)	37.5 (206)	
	TANF	2.6 (3)	4.6 (5)	3.7 (8)	5.5 (30)	
	None	35.9 (42)	17.6 (19)	13.8 (30)	10.9 (60)	*
Anxiety	Clinically significant	24.8 (29)	22.2 (24)	54.1 (118)	65.2 (358)	*
	Not clinically significant	75.2 (88)	75.9 (82)	44.5 (97)	33.5 (184)	
Depression	Clinically significant	21.4 (25)	18.5 (20)	43.6 (95)	61.2 (336)	*
	Not clinically significant	78.6 (92)	77.8 (84)	54.6 (119)	37.3 (205)	

1. *Abbreviations*: *HFS* High food security, *MFS* Marginal food security, *LFS* Low food security, *VLFS* Very low food security, *SNAP* Supplemental Nutrition Assistance Program, *WIC* Special Supplemental Nutrition Program for Women, Infants, and Children, *NSLP* National School Lunch Program, *TANF* Temporary Assistance for Needy Families

2. *Indicates a p value of < 0.001

3. Data presented as mean + SD or %(n)

of depression over the previous two weeks. Among all respondents, 40.7% ($n = 410$) reported clinically significant symptoms of both anxiety and depression. Mean experienced stigma was 3.1±1.1 and mean internalized stigma was 3.1±0.8. There was a medium effect of experienced stigma on anxiety and depressive symptoms ($d = 0.53$ and $d = 0.56$, respectively, $p < 0.001$). People reporting clinically significant symptoms of anxiety reported higher experienced poverty stigma (3.3±1.1) compared to those who did not (2.8±1.1; $p < 0.001$). Similar results were seen for depressive symptoms, 3.4±1.1 and 2.8±1.1 for those who reported and did not report clinically significant symptoms respectively ($p < 0.001$). The effect of internalized poverty stigma on anxiety and depressive symptoms was small ($d = 0.40$ and $d = 0.37$, respectively, $p < 0.001$).

Nearly two-thirds of respondents (65.2%, $n = 657$) were experiencing food insecurity and 10.7% (108) were experiencing marginal food security. As shown in Table 1, there were some notable differences in demographics by food security status. There were small effects of food security on SNAP participation ($\phi_c = 0.18$), pantry usage ($\phi_c = 0.20$), and no assistance usage ($\phi_c = 0.22$). As would be expected, usage of SNAP and food pantries were more common among respondents experiencing VLFS than those experiencing HFS ($p < 0.0001$). People experiencing VLFS were more likely to report poor health and less likely to report excellent health than people experiencing MFS and HFS ($\phi_c = 0.17$, $p < 0.0001$). Lastly, the effect of food security on anxiety and depressive symptoms was very strong ($\phi_c = 0.34$), with respondents experiencing VLFS more likely to report clinically significant symptoms of both anxiety and depression ($p < 0.0001$).

Model selection

The proposed model (shown in Fig. 1) was overfit and contained multiple nonsignificant pathways. Through a series of iterative models, non-significant pathways ($n = 3$) were systematically removed. The final retained model (Fig. 2; Table 2) was a good fit, based on a CFI = 1.00 and RMSEA < 0.001 (CI: 0.00-0.043). The χ^2 (df = 3, $n = 943$) = 1.64 was not significant ($p = 0.65$) indicating the predicted model and observed data were not significantly different, indicating good fit.

Retained model

In the retained model (Table 2), lower food security was associated with more internalized ($\beta = 0.10$, $p < 0.001$) and experienced stigma ($\beta = 0.34$, $p < 0.001$). Experienced stigma was also predicted by pantry usage in the previous

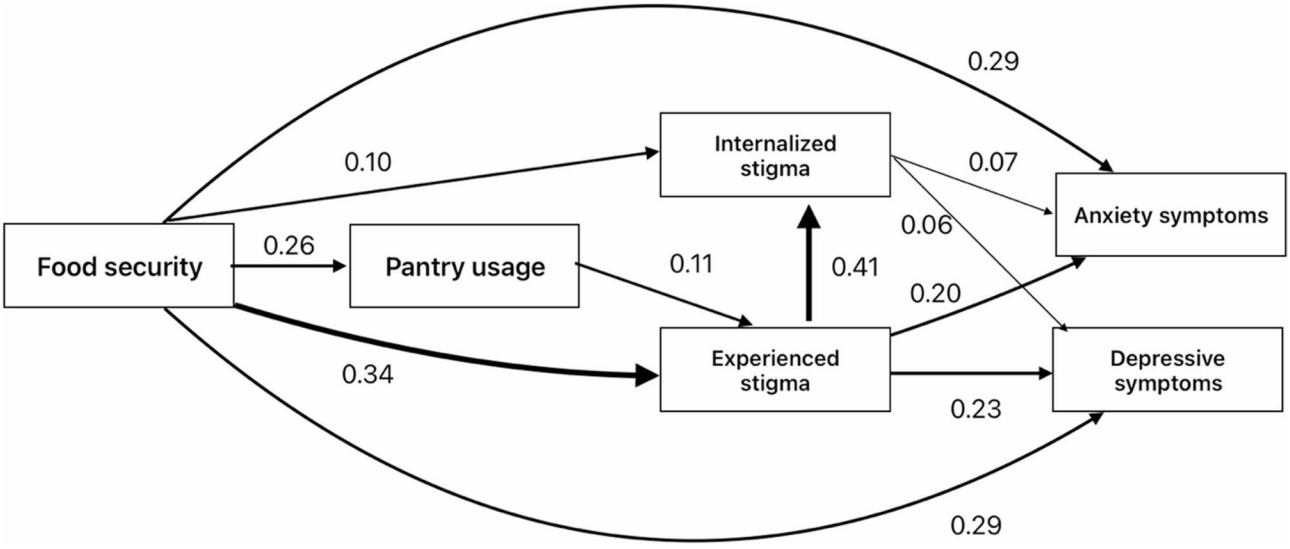

Fig. 2 Retained path diagram of the role of stigma in the relationship between food security and mental health among mothers (n=943)[1,2,3]
1. Food security is measured using the USDA Household Food Security Module (interval). Pantry usage over previous 12 months was binary (yes/no). Internalized and experienced stigma were both intervals and assessed with a poverty stigma tool from Mickelson and Williams. Anxiety and depressive symptoms were intervals and measured with the GAD-2 and PHQ-2, respectively. 2. Line thickness designates effect size with the largest effects indicated by the thickest lines. Effect sizes are the absolute value of the standardized regression coefficient. 3. Although not depicted in the figure to improve readability, the model did allow for covariance between symptoms of anxiety and depression

Table 2 Path model statistics for the role of stigma in the relationship between food security and mental health among mothers (n = 943)

	Estimate	Beta[1]	SE	*P*-value	Effect size[2]
Predictors of Pantry Usage					
Food Security	0.05	0.26	0.009	< 0.0001	Small
Predictors of Experienced Stigma					
Food Security	0.07	0.34	0.007	< 0.0001	Medium
Pantry Usage	0.12	0.11	0.05	0.02	Small
Predictors of Internalized Stigma					
Food Security	0.01	0.10	0.004	0.001	Small
Experienced Stigma	0.27	0.41	0.02	< 0.0001	Medium
Predictors of Anxiety Symptoms					
Experienced Stigma	0.36	0.20	0.06	< 0.0001	Small
Food Security	0.11	0.29	0.01	< 0.0001	Small
Internalized Stigma	0.19	0.07	0.08	0.02	Negligible
Predictors of Depressive Symptoms					
Experienced Stigma	0.43	0.23	0.06	< 0.0001	Small
Food Security	0.12	0.29	0.01	< 0.0001	Small
Internalized Stigma	0.17	0.06	0.09	0.04	Negligible

1. Beta is the standardized regression coefficient

2. Effect size is the absolute value of the Beta. >0.1 = small; >0.30 = medium, > 0.5 = large

Table 3 Regressions of stigma on food security, household size, income, and resource utilization[1,2,3,4]

	Experienced Stigma	Internalized Stigma
Intercept	2.36**	2.75**
Food Security	0.08**	0.04**
Income	−0.00008**	−0.000004*
Household Size	0.06*	0.04*
Pantry (241)	0.17*	0.04
TANF (46)	0.45*	0.17
NSLP (334)	0.05	−0.04
WIC (238)	0.01	0.07
SNAP (702)	−0.006	−0.09

1. *denotes p-value < 0.05, **denotes p < 0.001

2. Scores are on a 1 (low stigma) to 5 (high stigma) scale

3. SNAP- Supplemental Nutrition Assistance Program, WIC– Special Supplemental Nutrition Program for Women, Infants, and Children, NSLP- National School Lunch Program, TANF- Temporary Assistance for Needy Families

4. Number in paratheses denotes number of people who endorsed participating in that program

year, although this effect was small (β = 0.11, p = 0.018). There was also a medium effect (β = 0.41, p < 0.0001) of experienced stigma on internalized stigma. Anxiety symptoms were significantly predicted by experienced stigma (β = 0.20), food insecurity (β = 0.29), and internalized stigma (β = 0.07), although the effect of internalized stigma was very small (p < 0.01). Similar results were seen for depressive symptoms (see Table 2). The indirect pathways linking food security to both anxiety (β = 0.07, p < 0.0001) and depressive symptoms (β = 0.08, p < 0.0001) through experienced stigma were significant, although the indirect effect sizes were negligible.

Resource utilization and stigma

Table 3 shows the outputs of regressions of experienced and internalized stigma scores for participants and non-participants in different assistance programs. People who had visited a food pantry in the previous year reported

more experienced stigma (3.4 ± 1.2) than those who had not (3.0 ± 1.1), after controlling for differences in food security raw scores, income, and household size (+0.18, $p = 0.02$). Similarly, people who reported participating in the Temporary Assistance for Needy Families (TANF) program also reported greater experienced stigma (3.6 ± 0.9) compared to those who had not participated in the previous year (3.1±1.1). This effect was also significant after controlling for food security scores, income, and household size (+0.44, $p = 0.005$). Participation in SNAP, WIC, and NSLP did not significantly affect the model and were removed. These significant and non-significant effects persisted in models where each program was individually examined to address collinearity between programs. There were no significant differences in internalized stigma by participation in any program. After controlling for food security raw scores, there was no significant difference in experienced or internalized stigma by number of programs in which the respondent reported participation.

Discussion

The purpose of this study was to validate a conceptual framework including pathways through which internalized and experienced poverty stigma impact the relationship between food insecurity and maternal mental health in the southern US. The findings of this study highlight the potential importance of poverty stigma, particularly experienced stigma, in the relationship between food security and mental health. Furthermore, usage of food pantries and participation in TANF were associated with greater experienced stigma, while SNAP, WIC, and NSLP was not. These findings can be used to support the need for interventions and education to promote resource utilization by proactively minimizing stigma.

This study expands the literature on the relationship between food security status, stigma and maternal mental health. Existing literature suggests food is culturally viewed as an indicator of class and, therefore, a prominent pathway through which people may experience stigma manifested as stereotypes [36]. Repeated exposure to stereotypes (i.e. experienced stigma) is a stressor that contributes to poor mental health outcomes for multiple types of stigmas (e.g. racial, mental illness, HIV, poverty) [8, 37, 38]. This is consistent with the results of this study related to experienced poverty stigma and the effect on symptoms of anxiety and depression. Although the effect was negligible in this study, there is research to support the roles of internalized stigma and associated feelings of shame in contributing to maladaptive coping and poor mental health [8, 36]. Beddoe and Keddell (2016) argue a critical need to explicitly address shame and stigma to mitigate unintentional reinforcement of poverty stigma [39]. Further, they provide concrete examples of mitigating stigma in social work education through lessons designed to challenge the pervasive neoliberal discourse [39]. Future research should seek to translate these lessons into other settings where interactions with people experiencing poverty are common (e.g. food pantries, medical settings).

The findings from this study demonstrated that food pantry and TANF participants reported greater levels of experienced stigma than non-participants. This is in line with previous research on food pantry utilization being associated with experiences of stigma [40, 41]. Clients of food pantries have described several aspects of the process of obtaining food as stigmatizing [16, 42, 43]. On a structural level, the logistics of applying to access resources, limited hours of operation, and long wait times were identified as stressful and shameful [43]. Many pantry clients report a feeling of cognitive dissonance as they feel the need to be grateful for the resources but simultaneously feel stigma associated with the additional effort required to access food [43]. On an interpersonal level, unsolicited nutritional advice from well-meaning pantry staff and volunteers was identified as a source of perceived judgement [16, 42, 43]. These experiences of stigma may also contribute to greater internalized stigma, which was supported by the findings of this study [43]. Further, implementing health behavior change requires time, which mothers may not have after navigating these stigmatizing experiences associated with obtaining resources, potentially contributing to more stigma [44]. Organizers and public health researchers should also consider how strategies likely to have the largest effect when the intended outcome is improvement in traditional measures of diet (e.g., diet quality, fruits and vegetables) may be perceived by people experiencing food insecurity. Based on the findings of this study, this is especially important for practitioners and researchers focusing on TANF and food pantries where the significant effect was seen in this study.

There is significant historical context for stigmatization of participants in "welfare" programs (e.g. TANF) that intersects with other stigmas, particularly race and gender. Horan and Austin wrote in 1974 about the perception of participants in programs targeting people with low income as "underserving" of assistance [45]. These perceptions and the stigmatization of participation in programs like TANF have persisted, particularly among mothers who identify as people of color, and is often internalized [46, 47]. This is consistent with the findings of this study, which suggest participation in TANF and pantry may still be stigmatizing for people living in poverty. Stigma associated with the use of assistance programs has been consistently associated with poor mental health [46]. Furthermore, although outside the scope of this cross-sectional study, there is literature to support

that future resource utilization is affected by previous experiences of stigma [46]. However, having positive interactions in the setting where someone fears stigma is an effective way to reduce future stigma [48]. Therefore, researchers and policymakers should critically explore how these programs are framed and identify strategies to reduce stigma associated with participation. Based on the findings of this study, TANF and pantries may be important programs to target first to improve mental health among mothers experiencing food insecurity. Additionally, future research should explore how the effect of poverty stigma may differ across racial groups or by gender considering the historical context.

Understanding the role of poverty stigma in the relationship between food insecurity and mental health among mothers is critical, especially in the southern US given the continuation of health disparities in this region compared to other areas of the countries [22]. Furthermore, participation in assistance programs, like SNAP and TANF, among eligible participants fell below the national average for many states [49, 50]. This may be in part due to historical and persistent poverty and welfare stigma, especially among mothers who identify as Black. Future research should further explore the impact of racism and other forms of stigma (e.g. gender identity, HIV status) on the conceptual framework developed in this study. The findings of this study highlight that poverty stigma may be an important target for intervention in the southern US to address persistent health disparities.

There were several limitations of the present study. First, we recruited a convenience sample of participants and did not explore representativeness compared to the region. The prevelance of food insecurity in our sample was notably higher than the general population [51]. Although a convenience sample inherently limits generalizability, and the findings do not fully represent the broader population's experience with food insecurity, the conceptual framework developed aims to spotlight an underexplored pathway that warrants further investigation using nationally representative data. Additionally, because we only asked participants about experiences of poverty stigma, we cannot explore how poverty stigma may be interacting with other forms of stigma (e.g., race, weight, or age). This warrants future exploration to understand how potential interactions may influence the model to more fully address the experience of multiple types of discrimination [52]. Our data was self-report and particularly vulnerable to social desirability bias given the sensitive nature of topics included in the survey. This may limit the construct validity of some of our measurement tools. Finally, the sample consisted only of mothers, and we cannot know if effects might be present or different in other genders and in people without children. Although mothers are at particularly high risk for food insecurity and mental health concerns and thus represent an ideal starting point for understanding how stigma may impact the relationship, other demographic groups also merit investigation. For example, given evidence that people of minoritized gender identities are at elevated risk for both food insecurity and mental health concerns, future work should consider examining this model in a sample with greater diversity in gender [53].

Importantly, a cross-sectional sample was used for a mediation model (i.e. implying order of events), which has important limitations given the lack of a defined temporal sequence. Establishing temporal precedence is a key step for path analyses conducted on cross-sectional data and is typically based on logic and existing research, especially for the purposes of theory development. There is significant evidence in the literature describing the pathways through which poverty stigma contributes to poor mental health [9, 10, 18]. This is further supported by evidence that other forms of stigma, particularly HIV stigma, both experienced and internalized, contributes directly to poor mental health [37, 38]. Additionally, there is evidence supporting that utilizing assistance programs or the charitable food system to aquire food, which occurs when someone is experiencing food insecurity, can contribute to feelings of stigma and resulting shame [13–21]. The theoretical justification for the proposed direction of relationships included in the model is further supported by the time horizons of measures included in the study, making reverse causality unlikely given the short time horizon of the mental health measures (previous two weeks) compared to the food security measure (12 months). Therefore, based on both the time horizons of the measures and the robust existing literature on the relationship, it is likely that the conditions for temporal precedence have been sufficiently met for the objective of theory development. Future research should investigate the model using a longitudinal design that can allow for the interpretation of temporal relations between variables.

Conclusions

Our findings suggest stigma mitigation strategies are needed to support mothers in accessing food resources to potentially improve mental health outcomes. These may include removing structural (e.g. transportation, burdensome paperwork/verification processes) and social barriers (e.g. fear of judgment, cultural perceptions of assistance) to receiving support [43]. In this study, experienced stigma had an important role in the relationship between food security and mental health that warrants further investigation and intervention. However, addressing systemic issues is time intensive and mothers experiencing food insecurity in this study were reporting concerning symptoms of anxiety and

depression that warrant immediate attention. Therefore, as we work towards adapting the culture to promote non-stigmatized access to resources, especially for TANF and food pantries, accessible interventions aiming to help mothers cope with experiences of stigma and shame may improve mental health outcomes in the short term. Future research should qualitatively explore the relationship between experienced stigma, TANF participation, and pantries usage to better understand the stigmatizing aspects of those programs to inform the adaptation of the programs and the development of interventions to address the underlying stigma. Furthermore, future longitudinal studies are needed to further explore the theoretical framework proposed in this study.

Abbreviations

SNAP	Supplemental Nutrition Assistance Program
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children
TANF	Temporary Assistance for Needy Families
NSLP	National School Lunch Program
HFS	High Food Security
MFS	Marginal Food Security
LFS	Low Food Security
VLFS	Very Low Food Security
CFI	Comparative Fit Index
RSMEA	Root Mean Square Error of Approximation

Supplementary Information

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Supplementary Material 1.

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Authors' contributions
The authors' responsibilities were as follows – RAL, LMA, AB, HD, SAM: designed research; RAL, TK, RA: conducted research; RAL, LMA, SAM: developed methodology; RAL, TK, SAM: analyzed the data; RAL, TK, RA: wrote the paper; LMA, AB, HD, SAM: reviewed and edited the paper; RAL: administered the project and was primarily responsible for the final content; and all authors: read and approved the final manuscript.

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Data availability
The datasets generated and/or analysed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Oklahoma State University IRB. Informed consent was waived by the Oklahoma State University IRB and consent to participate was implied by advancing the survey beyond the information sheet. Implied consent was obtained from all subjects in accordance with the IRB guidelines.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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