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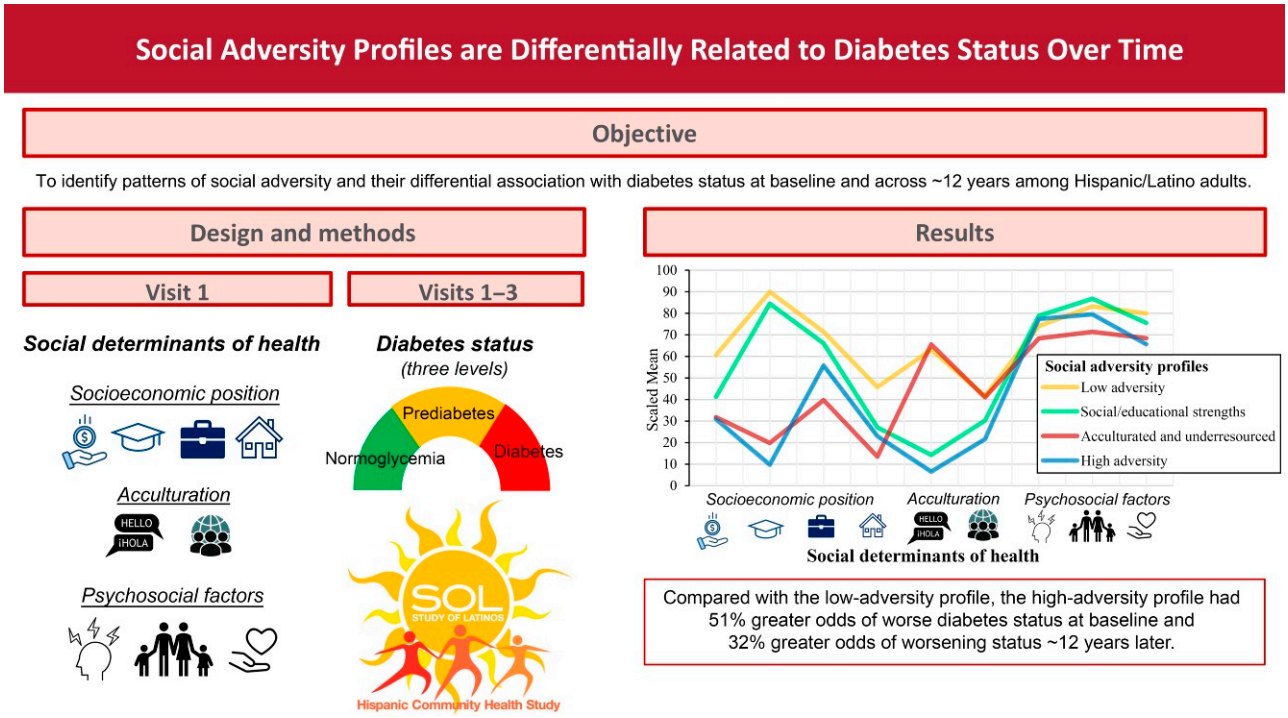

ARTICLE HIGHLIGHTS

- **Why did we undertake this study?**
  Social determinants of health often cluster, but how these patterns influence diabetes status is poorly understood.
- **What is the specific question(s) we wanted to answer?**
  How do social adversities cluster together, and are these patterns differentially related to diabetes status over time?
- **What did we find?**
  Four distinct patterns of social adversity emerged, with the odds of worsening diabetes status becoming incrementally greater as the profiles represented greater adversity.
- **What are the implications of our findings?**
  Social adversity patterns provide insight into the specific resources needed to support diabetes prevention and management.

Profiles of Social Determinants of Health and Change in Diabetes Status Among U.S. Hispanic/Latino Adults: HCHS/SOL, 2008–2024

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ORIGINAL ARTICLE

OBJECTIVE

Social determinants of health (SDoHs) account for more than half of the variance in racial and ethnic disparities in health. However, few studies have examined how SDoHs may cluster in ways that affect health. We aimed to identify patterns of social adversity and their differential associations with both diabetes status at baseline and change in diabetes status across ∼12 years among Hispanic/Latino adults.

RESEARCH DESIGN AND METHODS

Participants were from the Hispanic Community Health Study/Study of Latinos (HCHS/SOL; *N* = 16,415; aged 18–74 years). Diabetes status (defined as normoglycemia, prediabetes, or diabetes per American Diabetes Association criteria) was measured by clinical assessment and self-reported medications at baseline (2008–2011) and two follow-up visits (2014–2017 and 2020–2024). SDoHs were assessed at baseline and as part of the HCHS/SOL Sociocultural Ancillary Study (2010–2012).

RESULTS

Latent class analyses of nine SDoHs (income, education, employment status, home ownership, language and social acculturation, chronic stressors, family cohesion, and social support) revealed four distinct patterns of social adversity: *1*) low adversity, *2*) social/educational strengths, *3*) acculturated and underresourced, and *4*) high adversity. Compared with the low-adversity group, the high-adversity group had the highest odds of worse diabetes status at baseline and had greater odds of worsening diabetes status over time.

CONCLUSIONS

SDoHs cluster in distinct ways that affect diabetes outcomes; social adversities must be addressed to mitigate diabetes burden among Hispanic/Latino adults.

Hispanic/Latino adults are 60% more likely to be diagnosed with diabetes and twice as likely to be hospitalized with diabetes-related complications compared with non-Hispanic White individuals (1), although physician-diagnosed diabetes accounts for only a portion of all cases. Data from the Hispanic Community Health Study/Study

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of Latinos (HCHS/SOL), an ongoing prospective cohort study of health and disease in U.S. Hispanic/Latino adults, showed an overall diabetes prevalence of nearly 17%, with only approximately half (59%) having a physician diagnosis before their baseline study visit (2). Rates of prediabetes are also high, affecting more than one-third (34.5%) of U.S. Hispanic/Latino adults, according to recent national data (3). Moreover, diabetes prevalence increased from 17% to almost 25% within the first 6 years of the HCHS/SOL follow-up (2,4), indicating a critical need to understand determinants of incident or worsening diabetes status in this population.

Social determinants of health (SDoHs), or "the conditions of daily life … in which people are born, grow, live, work, and age" (5), account for more than half of the variance in racial and ethnic health disparities (6). The World Health Organization SDoH conceptual framework (5) highlights how structural determinants (e.g., socioeconomic position and cultural context) interact to influence downstream intermediary determinants (e.g., psychosocial factors), ultimately affecting health and health equity. Several studies have established that a range of structural and intermediary SDoHs (e.g., income, education, and social support) are independently (7,8) or cumulatively (i.e., using count scores) (9,10) related to diabetes. However, despite acknowledgment that SDoHs are interrelated and do not occur in isolation, few studies have examined how SDoHs cluster or how these patterns relate to health.

One data-driven approach that is useful for identifying patterns across interrelated variables is latent class analysis (LCA) (11). LCA can identify underlying subgroups within a population that share a common set of social adversities. Recently, researchers have begun using LCA to understand how social adversity profiles relate to diabetes prevalence (12,13), incidence (14), or glycemic control (15). In general, these studies show that profiles with the highest adversity across indicators are associated with the worst outcomes. However, past studies have included limited indicators (e.g., economic and demographic only) (13) or emphasized neighborhood-level factors (e.g., crime rate and rurality) (12,16) and primarily used cross-sectional designs (with the exception of the study by Hendryx et al. [14]). Hispanic/Latino adults have been largely underrepresented in this work, limiting understanding of how social and cultural factors cluster to affect diabetes risk in this population. Accordingly, the current study sought to *1*) identify distinct profiles of social adversity among U.S. Hispanic/Latino adults and *2*) examine how these profiles relate to diabetes status at baseline and changes in diabetes status over time.

RESEARCH DESIGN AND METHODS

Participants and Procedures

HCHS/SOL is a prospective, population-based study of U.S. Hispanic/Latino adults from diverse backgrounds. The HCHS/SOL design and procedures have been previously reported (17–19). Institutional review boards at all field centers approved the study procedures, and all participants provided consent. Between 2008 and 2011, participants were recruited from four major U.S. metropolitan areas with large Hispanic/Latino populations: Bronx, Chicago, Miami, and San Diego. Stratified random sampling was used to establish a baseline cohort representative of these target communities. Participants (n = 16,415; aged 18–74 years) completed a baseline clinic visit (V1) with assessments of diabetes status and most of the SDoH indicators, including the socioeconomic and acculturation measures. Within 4 to 9 months of V1, a representative subset of HCHS/SOL participants (n = 5,313) completed additional psychosocial assessments as part of the Sociocultural Ancillary Study (SCAS) (20). All living and eligible HCHS/SOL participants were invited to follow-up visits, approximately 6 years apart (visit 2 [V2]: 2014–2017, n = 11,619; visit 3 [V3]: 2020–2024, n = 9,076), during which diabetes status and other assessments were repeated. For the current study, we included all participants with any available SDoH data (N = 16,371).

Measures

Diabetes Status

Diabetes status was categorized according to American Diabetes Association criteria (21) as follows: 0 = normoglycemia, 1 = prediabetes, and 2 = diabetes. At V1, participants reported medication use and completed clinical assessments of fasting plasma glucose, 2-h post–oral glucose tolerance test (OGTT), and percentage of glycosylated hemoglobin (HbA_{1c}). Participants who met any of the American Diabetes Association criteria for diabetes (fasting glucose ≥126 mg/dL, post-OGTT ≥200 mg/dL, or HbA_{1c} ≥6.5%) or self-reported use of medication for diabetes were categorized as having diabetes. Participants who did not meet diabetes criteria but met any of the criteria for prediabetes (fasting glucose 100–125 mg/dL, post-OGTT 140–199 mg/dL, or HbA_{1c} 5.7–6.4%) were categorized as having prediabetes. All others were categorized as normoglycemic (fasting glucose <100 mg/dL, post-OGTT <140 mg/dL, and HbA_{1c} <5.7%; no medication). Diabetes status was assessed using these same criteria at follow-up V2 and V3, with the exception that post-OGTT was not performed at V3.

SDoHs

Applying the World Health Organization framework (5) to variables measured in HCHS/SOL, we included SDoHs reflecting structural and intermediary determinants of health. Nine SDoHs assessed at V1 (income, education, employment status, home ownership, language and social acculturation, chronic stress, family cohesion, and social support) were selected for inclusion in analyses. Three additional SDoHs (health insurance, nativity, and discrimination) were considered but ultimately excluded (selection process described in Supplementary Material). These nine (of 12 possible) SDoHs were selected based on preliminary weighted, survey-adjusted regression analyses showing each was individually associated with V1 diabetes status after adjusting for covariates (Supplementary Table 1).

All variables were coded such that lower values indicate the direction or groups assumed to represent greater adversity. Socioeconomic factors included annual household income (1 = <$10,000, 2 = $10,001–20,000, 3 = $20,001–40,000, 4 = $40,001–75,000, or 5 = >$75,000), education (1 = less than high school, 2 = high school or equivalent, or 3 = more than high school), employment status (0 = not currently employed and not retired or 1 = employed or retired), and home ownership (0 = rented or occupied without payment or 1 = owned by you or someone in household).

Acculturation into U.S. or European American cultural norms was assessed

using modified versions of two subscales from the Short Acculturation Scale for Hispanics (22). The language acculturation subscale is the average of six items, each rated from 1 to 5, with lower scores representing predominantly Spanish use and higher scores representing predominantly English use. The social acculturation subscale is the average of four items, each rated from 1 to 5, with lower scores representing a predominantly Hispanic/Latino social network and higher scores representing a predominantly non-Hispanic/non-Latino social network.

Psychosocial factors were assessed as part of the SCAS visit (20), which was approximately concurrent with V1. Chronic stress was assessed as the total number of stressors (out of eight) in key life domains (e.g., relationship problems and subjective financial strain) lasting at least 6 months (23); summed scores were reverse coded so that lower scores indicated more chronic stressors. Family cohesion was assessed using the nine-item subscale of the Family Environment Scale (24), in which participants responded true or false to statements about the closeness and supportiveness of their family; scores were summed and standardized based on validated cross-cultural normative data (24), with lower scores indicating less family cohesion. Social support was assessed via the Interpersonal Support Evaluation List, 12-item version (25), in which participants responded to items assessing the perceived availability of social support (rated from 0 to 3); scores were summed, with lower values indicating less perceived support.

Demographic Information

Additional information collected at V1 included age (in years), sex (0 = female or 1 = male), and Hispanic/Latino heritage (Dominican, Central American, Cuban, Mexican, Puerto Rican, South American, or other/more than one heritage). As applicable, ages (in years) at V2 and V3 were used as an index for time between visits.

Analytic Strategy

Descriptive analyses were conducted in SPSS (version 29.0). Primary analyses were conducted in Mplus (version 8.6) using LCA and proportional odds ordinal regression models (described below). All estimates were calculated using the maximum likelihood robust procedure in Mplus, a full-information maximum likelihood approach that is robust to nonnormality and provides unbiased estimates using all available data (26,27); we also used Monte Carlo integration for the ordinal regression models, as implemented by Mplus (27). Apart from the LCA models (which were unweighted, given the data-specific nature of this approach), all other reported statistics were weighted according to the target population and accounted for the HCHS/SOL complex sampling design, including adjustments for disproportionate selection, differential nonresponse, and clustering at the neighborhood stratum and household level (details reported by Lavange et al. [17]).

LCA

LCA is a data-driven, person-centered approach that identifies patterns in data and groups individuals into profiles (or latent classes) based on shared similarities of those patterns (11). To identify profiles of social adversity, the nine SDoHs (described above) were included in the LCA models (N = 16,371; 44 participants were excluded because they were missing all nine variables). To determine the optimal number of social adversity groups, we sequentially estimated LCA solutions with two to four potential latent classes. Each model included the binary and continuous SDoH variables in their original scale. We chose the four-class solution based on model fit indices, including the Akaike information criterion, sample size–adjusted Bayesian information criterion, Lo-Mendell-Rubin adjusted likelihood ratio test, bootstrapped likelihood ratio test, and entropy (Supplementary Table 3), as well as overall conceptual interpretability. We also evaluated whether the four social adversity groups differed on each of the nine SDoH indicators using survey-adjusted regression models (logistic or linear as appropriate); group differences that met statistical significance ($P < 0.05$) are reported (full models not shown). Finally, we visualized the patterns across each social adversity group by rescaling and plotting all SDoH variables (unweighted) on a 0–100 scale. Aligned with previous work (28), binary variables were plotted in terms of percentage, and continuous variables were rescaled using the overall minimum and maximum observed values of each variable (i.e., min-max normalization): $([x - x_{\min}]/[x_{\max} - x_{\min}]) * 100$.

Proportional Odds Ordinal Regression Models

After identifying the social adversity profiles, we conducted proportional odds ordinal regression models, testing their association (dummy coded, with low-adversity as reference) with diabetes status (normoglycemia, prediabetes, or diabetes; tested as a three-level ordinal outcome) at V1 and with changes in diabetes status across time. A Brant-Wald test confirmed that the proportional odds assumption was sufficiently met ($P > 0.001$). Under the proportional odds assumption, the odds of being in a higher outcome category are the same across all pairs of outcome categories. Therefore, the odds ratios (ORs) for the cross-sectional model estimated the odds of having worse diabetes status at V1 (i.e., odds of having diabetes or prediabetes vs. normoglycemia and of having diabetes vs. prediabetes or normoglycemia). The longitudinal model simultaneously estimated the odds of worsening diabetes status (i.e., progression from normoglycemia to prediabetes or diabetes or from prediabetes to diabetes) at V2 and V3 for each social adversity group compared with the low-adversity reference group.

These models excluded an additional 14 participants with missing diabetes data. The cross-sectional model (n = 16,357) adjusted for age, sex, Hispanic/Latino heritage, and field center (Bronx, Chicago, Miami, or San Diego). Consistent with prior work examining predictors of worsening diabetes status over time (29), the longitudinal model (n = 13,163) further excluded 3,194 participants who already had diabetes at V1 and additionally adjusted for time elapsed between visits.

Sensitivity Analyses

Given that psychosocial indicators (chronic stress, family cohesion, and social support) of SDoHs were assessed only in the subset of participants who completed the SCAS visit, we reexamined the LCA models in two ways, minimizing missingness to ensure their consistency. First, we repeated the LCA models using the SCAS sample only (n = 5,313). Second, because the psychosocial variables were later integrated into the V2 examination among

all HCHS/SOL participants, we next repeated the LCA models using the full analytic sample (N = 16,371) but with V2 scores substituted for missing V1 data for chronic stress, family cohesion, and social support (only).

Associations of social adversity phenotype with diabetes status at V1 and over time were also tested for effect modification by age (in years), sex (male vs. female), or nativity/years in the U.S. (U.S. born vs. <10 years in U.S. vs. ≥10 years in U.S.). Given the number of inferential statistical tests, a more stringent α level of 0.01 was used when interpreting the statistical significance of these interaction model parameters.

Data and Resource Availability

The data and computer code used for this analysis reside at San Diego State University. HCHS/SOL fully supports data sharing for HCHS/SOL-approved manuscript proposals with outside investigators. All data sharing is conducted in accordance with HCHS/SOL and National Institutes of Health policies and governed by a data and materials distribution agreement between the University of North Carolina and the external institution, ensuring the confidentiality and privacy of HCHS/SOL participants and their families. Alternatively, deidentified HCHS/SOL data are publicly available at BioLINCC and dbGaP for the subset of the study cohort authorizing general use of their data at the time of informed consent.

RESULTS

Descriptive Information

Table 1 lists baseline (V1) characteristics for the study sample (N = 16,371) and across social adversity profile groups, weighted to the target population. Slightly more than half (52%) of individuals in the target population were women, most had an annual household income of $40,000 or less (~80%), and approximately two-thirds reported at least a high school education (~68%). Most (77%) were born outside the U.S., but nearly half (49%) had been living in the U.S. for 10 years or longer. Unweighted bivariate correlations among the nine SDoHs were low to moderate (correlation [r] coefficients ranged from 0.0001 to 0.53) (Supplementary Table 2). Overall, approximately 36% were identified as having prediabetes and 15% as having diabetes at V1 (Table 1); detailed population prevalence estimates are reported in prior publications (2,30). Table 1 lists diabetes status prevalence by social adversity profile.

Identifying Social Adversity Profiles

The four-class solution provided the best fit based on most indices (Supplementary Table 3) and yielded the most conceptually meaningful and interpretable profiles. The four social adversity profiles were labeled according to the patterns of SDoHs that emerged from the LCA, a process that was both descriptive and informed by the post hoc tests of statistical differences across groups (11). Figure 1 depicts a visualization of these patterns using scaled means. Table 1 shows descriptive information across the four profiles, with major differences further described below.

The first profile was considered the low-adversity group (~16% of the sample) because it was characterized by the least relative adversity across nearly all SDoH indicators, including having higher income, higher education level, relatively greater probability of home ownership, and greater availability of social support, compared with all other groups ($P < 0.05$ based on survey-adjusted regression models; data not shown). Individuals in this group were also among the most likely to be employed and reported the highest levels of language and social acculturation relative to most other groups (Table 1 and Fig. 1). Individuals in the low-adversity group were, on average, 34.98 years old (SE 0.44), and most were either born in the U.S. (61%) or had been living in the U.S. for 10 years or longer (35%).

The second profile was labeled the social/educational strengths group (~34% of the sample) because this group had the strongest family cohesion and the second-highest educational attainment and social support levels, on average, compared with all other groups ($P < 0.05$ based on survey-adjusted regression models; data not shown). Despite these strengths, this group was characterized by comparatively low levels of language and social acculturation. The mean age of individuals in this group (mean [SE] 42.38 [0.32] years) was close to the average age of the target population, and most (94%) were born outside the U.S. (51% living in U.S. ≥10 years; 43% living in U.S. <10 years).

Conversely, the acculturated and underresourced group (~10% of the sample) was characterized by the opposite pattern. Individuals in this group reported the highest language acculturation, but relatively fewer socioeconomic resources (lowest likelihoods of employment and home ownership) and fewer psychosocial resources (highest chronic stress and lowest family cohesion), compared with all other groups ($P < 0.05$ based on survey-adjusted regression models; data not shown). Individuals in this group were, on average, 32.91 years old (SE 0.49), and most were either born in the U.S. (63%) or had been living in the U.S. 10 years or longer (33%).

Finally, the high-adversity group (~40% of the sample) was characterized by the most relative adversity across nearly all SDoH indicators, including the lowest education level, lowest language and social acculturation levels, and lowest availability of social support, compared with all other groups ($P < 0.05$ based on survey-adjusted regression models; data not shown). Individuals in this group were, on average, 46.31 years old (SE 0.39). Similar to individuals in the social/educational strengths group, most (98%) were born outside the U.S. (63% living in U.S. ≥10 years; 35% living in U.S. <10 years).

Linking Social Adversity Profiles With Diabetes Status

Results for the cross-sectional model are reported in Table 2. Compared with the low-adversity group, the acculturated and underresourced group exhibited 32% higher odds (OR 1.32; P = 0.007) and the high-adversity group exhibited 51% higher odds (OR 1.51; $P < 0.001$) of having worse diabetes status at V1. The social/educational strengths group also exhibited worse diabetes status at V1 compared with the low-adversity group, but this difference did not reach statistical significance (OR 1.16; P = 0.056).

In the longitudinal model (Table 2), among individuals without diabetes at V1, the high-adversity group exhibited 28% higher odds (OR 1.28; P = 0.007) of worsening diabetes status by V2 and 32% higher odds (OR 1.32; P = 0.013) of worsening diabetes status by V3 compared

Table 1—Baseline characteristics by total sample and social adversity profiles

Characteristic	Total	Low adversity	Social/educational strengths	Acculturated and underresourced	High adversity
Total, *n* (%)	16,371	2,588 (15.81)*	5,623 (34.35)*	1,660 (10.14)*	6,500 (39.70)*
Age, years	41.05 (40.56, 41.54)	34.98 (34.13, 35.83)	42.38 (41.75, 43.00)	32.91 (31.95, 33.87)	46.31 (45.56, 47.07)
Sex					
Female	52.11	47.07	52.97	48.01	55.74
Male	47.89	52.93	47.03	51.99	44.26
Hispanic/Latino heritage					
Dominican	9.94	9.02	9.94	8.51	11.04
Central American	7.40	4.11	7.79	4.14	10.19
Cuban	20.02	8.52	29.93	7.77	20.95
Mexican	37.37	38.48	34.86	27.93	42.93
Puerto Rican	16.15	27.26	7.10	43.39	8.88
South American	4.98	3.18	7.77	1.61	4.36
More than one heritage/other	4.13	9.43	2.61	6.64	1.63
Field center					
Bronx	28.94	34.03	20.35	50.58	26.88
Chicago	15.81	16.39	11.25	16.53	20.02
Miami	29.31	14.15	41.79	12.49	31.42
San Diego	25.94	35.43	26.60	20.39	21.68
Nativity/years in U.S.					
<10	27.66	3.80	42.76	3.81	34.91
≥10	49.44	35.46	50.72	32.67	62.79
U.S. born	22.90	60.74	6.51	63.52	2.30
Diabetes status					
Normoglycemic	49.64	62.31	49.85	60.39	37.83
Prediabetes	35.64	29.20	36.95	29.68	40.31
Diabetes	14.72	8.49	13.19	9.93	21.86
Income, $					
<10,000	14.63	4.58	11.37	23.17	21.61
10,001–20,000	31.65	13.58	31.56	35.52	42.09
20,001–40,000	33.29	31.61	37.60	32.50	29.84
40,001–75,000	14.55	31.00	15.47	7.55	5.43
>75,000	5.88	19.24	4.00	1.27	1.03
Education level					
Less than high school	32.35	0	0	58.20	76.31
High school or equivalent	28.20	20.69	31.83	41.80	23.69
More than high school	39.46	79.31	68.17	0	0
Employment status					
Not employed and not retired	41.01	31.85	35.22	63.16	44.37
Employed or retired	58.99	68.15	64.78	36.84	55.63
Home ownership					
Rented or occupied without payment	75.49	56.30	75.80	86.15	82.60
Owned by you or someone in household	24.51	43.70	24.20	13.85	17.40
Language acculturation	2.13 (2.09, 2.18)	3.56 (3.52, 3.60)	1.61 (1.58, 1.63)	3.67 (3.62, 3.72)	1.26 (1.25, 1.28)
Social acculturation	2.24 (2.22, 2.26)	2.65 (2.62, 2.68)	2.22 (2.20, 2.24)	2.64 (2.61, 2.68)	1.87 (1.85, 1.89)
Chronic stress (reversed)†	6.19 (6.12, 6.26)	6.12 (5.95, 6.29)	6.38 (6.28, 6.48)	5.61 (5.39, 5.84)	6.25 (6.14, 6.36)
Family cohesion†	54.02 (53.33, 54.71)	54.70 (53.44, 55.96)	57.03 (56.13, 57.92)	46.67 (43.92, 49.41)	53.18 (52.26, 54.09)
Social support†	26.42 (26.14, 26.71)	29.15 (28.68, 29.61)	27.64 (27.23, 28.06)	24.99 (25.09, 25.89)	24.05 (23.61, 24.49)

Data given as weighted estimates of mean (95% CI) or percentage, unless otherwise noted. *Unweighted. †Variables assessed at baseline only among participants who completed the SCAS visit (*n* = 5,313).

with the low-adversity group. Similarly, the acculturated and underresourced group exhibited 33% higher odds (OR 1.33; *P* = 0.044) of worsening diabetes status by V3 compared with the low-adversity group. No other statistically significant group differences emerged for changes in diabetes status across time; however, in general, the ORs for worsening diabetes status increased as the SDoH profiles represented greater adversity.

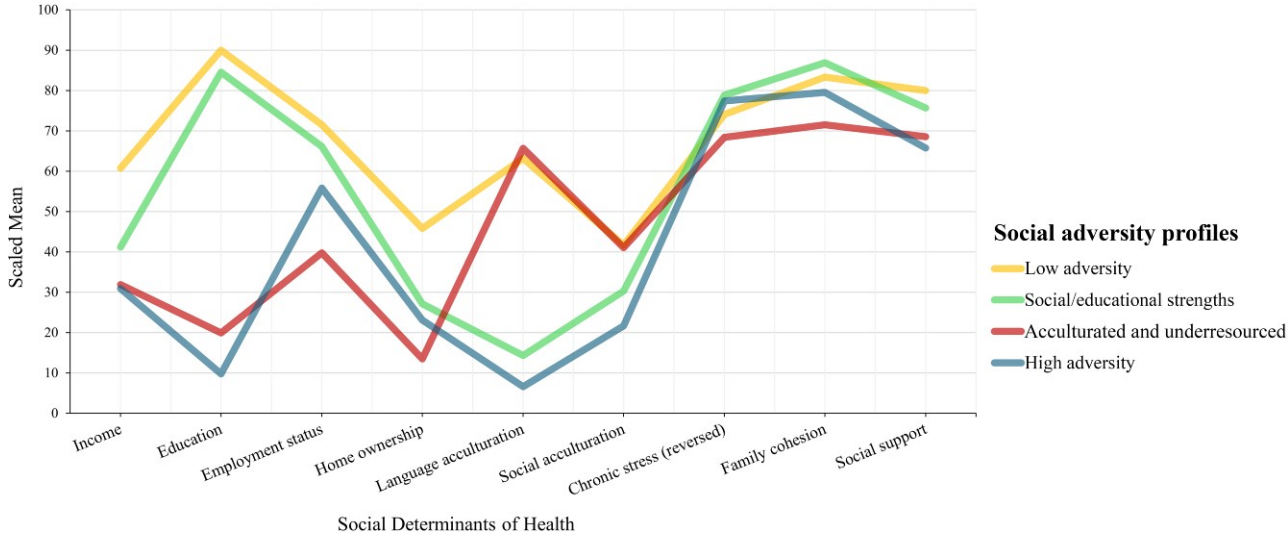

Figure 1—Patterns of SDoHs across social adversity profiles. Visualization of four social adversity profiles identified in LCA. All variables scaled on 0–100 scale. Binary variables (employment status, home ownership) plotted in terms of percentage; all other variables treated as continuous and rescaled using min-max normalization.

Sensitivity Analyses

The LCA results were similar across the sensitivity models, providing further support that our original four-class solution reflected the best representation of the data. This consistency also reaffirms that addressing missing data using full-information maximum likelihood for those who did not participate in the SCAS visit was appropriate. No statistically significant effect modifications by age, sex, or nativity/years in the U.S. were found in either the cross-sectional or longitudinal regression models (all *P* values >0.01).

CONCLUSIONS

The current study examined how SDoHs cluster in distinct patterns of social adversity and how these patterns are differentially related to diabetes status at baseline and change in diabetes status over time. Using data from HCHS/SOL, an ongoing prospective study representative of Hispanic/Latino adults from diverse backgrounds across four major U.S. cities, we identified four distinct social adversity profiles that were differentially related to diabetes status across the 12-year study period. Notably, the high-adversity group (i.e., group characterized by the most relative adversity across nearly all SDoH indicators) not only was most likely to have prediabetes or diabetes at baseline but also had the greatest odds of worsening diabetes status across both follow-up visits.

It is well recognized that SDoHs, or nonmedical factors such as social and psychological adversities, are interwoven and often overlap. A few studies have examined social adversity patterns among predominantly non-Hispanic Black and/or White sample populations (12–16). However, these findings may not extend to other racial or ethnic minority populations, and these studies were often limited to cross-sectional designs. The current study included indicators of cultural context (e.g., acculturation), along with socioeconomic and psychosocial factors, and examined how distinct adversity profiles were related to change in diabetes status among U.S. Hispanic/Latino adults. Consistent with a dose-response relationship, the odds of worsening diabetes status became incrementally greater as the level of social adversity increased across the four

Table 2—Associations between social adversity profiles and diabetes status at baseline and across 12 years (visits 1–3)

	Cross-sectional model* (*n* = 16,357)		Longitudinal model† (*n* = 13,163)			
	V1		V2		V3	
Profile	OR	95% CI	OR	95% CI	OR	95% CI
Low adversity (reference)	—	—	—	—	—	—
Social/educational strengths	1.16‡	1.00, 1.35	1.08	0.91, 1.27	1.23‡	0.98, 1.55
Acculturated and underresourced	1.32§	1.08, 1.61	1.16	0.90, 1.50	1.33‖	1.01, 1.76
High adversity	1.51¶	1.28, 1.77	1.28§	1.07, 1.53	1.32‖	1.06, 1.64

Results from two separate proportional odds ordinal regression models in which three-level diabetes status (normoglycemia, prediabetes, diabetes) at baseline (V1; cross-sectional model) and V2 and V3 (longitudinal model) were regressed on social adversity profile. Both models adjusted for age, sex, Hispanic/Latino heritage, and field center and were weighted and accounted for complex sample design. *Cross-sectional model ORs represent odds of having worse diabetes status at V1 (i.e., diabetes or prediabetes vs. normoglycemia; diabetes vs. prediabetes or normoglycemia). †Longitudinal model excluded participants with diabetes at V1 and additionally adjusted for time between visits. ORs represent odds of worsening diabetes status (i.e., progressing from normoglycemia to prediabetes or diabetes or from prediabetes to diabetes) at V2 or V3. ‡$P < 0.10$. §$P < 0.01$. ‖$P < 0.05$. ¶$P < 0.001$.

profiles. Compared with the low-adversity group (i.e., group characterized by the least relative adversity across nearly all SDoH indicators), the social/educational strengths group (i.e., characterized by some adversity but also strong levels of family cohesion and educational attainment) trended in the direction of slightly worse diabetes status, although not statistically significant at any time point. The acculturated and underresourced group (i.e., characterized by slightly greater adversity despite a high level of acculturation) exhibited significantly worse diabetes status at baseline compared with the low-adversity group, although differences in disease progression (i.e., worsening diabetes status) were not evident until 12 years later. Finally, the high-adversity group exhibited significantly worse or worsening diabetes across all visits, with significantly higher odds of disease progression occurring earliest (both 6 and 12 years later) in this group, compared with the low-adversity group.

These findings extend previous work in HCHS/SOL showing that individual psychosocial risk factors (e.g., lower social support and social integration) (7) and higher numbers of adverse SDoHs (dichotomized and summed) (9) are cross-sectionally associated with diabetes prevalence. We demonstrated that SDoHs cluster in specific patterns that are differentially associated with worse diabetes status at baseline, as well as worsening diabetes status over time. Furthermore, by identifying naturally occurring patterns of social adversity, these findings advance our understanding of the influence of SDoHs and inform future prevention and intervention efforts.

Diabetes is one of the most expensive chronic conditions in the U.S. (31,32). Prevention and management of type 2 diabetes and prediabetes require substantial resources (e.g., access to nutritious foods, social support to maintain healthy behaviors, and regular health care visits), making individuals who experience social adversity particularly susceptible to developing or worsening diabetes. Health care settings have increasingly moved toward screening for SDoHs and supporting patients through medical and community resources (33). However, best practices for addressing SDoHs in diabetes prevention and management are not fully established, and integrated social care interventions are difficult to fund and sustain.

Our findings have important implications for practice and policy. For practitioners, this study underscores the value of integrated assessments and referral strategies that move beyond single SDoH indicators to consider the interplay of structural, psychosocial, and sociocultural vulnerabilities. From a policy perspective, the distinct social adversity profiles suggest how interventions can be tailored to specific strengths and barriers within U.S. Hispanic/Latino communities. For instance, some Hispanic/Latino adults may possess strong social support systems but require additional support navigating health care settings where English language proficiency is required (e.g., social/educational strengths group), whereas others may easily navigate scenarios requiring English language proficiency but benefit more from structured health behavior support (e.g., acculturated and underresourced group). Interventions that address SDoHs across the continuum of upstream (e.g., structural) and downstream (e.g., psychosocial) factors may be most effective in mitigating long-term diabetes risk. Policies that link health care with social services may be particularly important for altering disease trajectories in this population.

Limitations and Future Directions

Findings should be interpreted with strengths and limitations in mind. Psychosocial data were available for a subset of participants at baseline; however, sensitivity tests suggested our findings were robust to missingness and materially unchanged. Additionally, post-OGTT was performed at V1 and V2, but not V3, making it possible that V3 diabetes and prediabetes prevalence was underestimated (34). Finally, future work is needed to examine additional SDoHs and contexts that were not assessed in this study. HCHS/SOL is representative of four major metropolitan cities, but social adversities may differ in rural versus urban settings (35,36) because of differential housing costs, transportation access, and other barriers. Food insecurity and neighborhood walkability are additional SDoHs to consider, given the importance of nutrition and physical activity for cardiometabolic health. Unhealthy eating patterns are often associated with lower socioeconomic status and higher acculturation (37). Prior HCHS/SOL analyses showed that neighborhood socioeconomic deprivation, but not built environment (e.g., walkability), predicts cardiometabolic risk over time (29). Diet and exercise may reflect behavioral mechanisms not examined in the current study, but future research could investigate such pathways. To our knowledge, this study is among the first to link naturally occurring social adversity profiles with diabetes status among U.S. Hispanic/Latino adults, highlighting that SDoHs must be addressed to mitigate diabetes risk among this population.

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