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Selected Papers from the Editorial Board

High Prevalence of Adverse Social Determinants of Health in Dialysis Access Creation Patients in a Safety-Net Setting

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Background: Patients receiving dialysis access surgery are often exposed to adverse social determinants of health (SDH) that negatively impact their care. Our goal was to characterize these factors experienced by our arteriovenous dialysis access patients and identify differences in health outcomes based on their SDH.

Methods: We performed a retrospective cohort study of all patients who underwent dialysis access creation (2017−2021) and were screened for SDH at a clinical visit (using THRIVE survey) implemented at an urban, safety-net hospital institution within 1 year of access creation. Demographics, procedural details, early postoperative outcomes, survey responses, and referral to our hospital's preventive food pantry were recorded. Univariable analysis and multivariable analyses were performed to assess for associations with key health outcomes.

Results: There were 190 patients who responded to the survey within 1 year of their operation. At least 1 adverse SDH was identified in 42 (22%) patients. Normalized to number of respondents for each question, adverse SDH identified were difficulty obtaining transportation to medical appointments (18%), food insecurity (16%), difficulty affording utilities (13%), difficulty affording medication (12%), unemployed and seeking employment (9%), unstable housing (7%), difficulty caring for family/friends (6%), and desiring more education (5%). There were 71 (37%) patients who received food pantry referrals. Mean age was 60 years and 38% of patients were female and 64% were Black. More than half of patients (57%) had a tunneled dialysis catheter (TDC) at the time of access creation. Dialysis accesses created were brachiocephalic (39%), brachiobasilic (25%), radiocephalic fistulas (16%), and arteriovenous grafts (14%). Thirty-day emergency department (ED) visits, 30-day readmissions, and 90-day mortality occurred in 23%, 21%, and 2%, respectively. On univariable and multivariable analyses, any adverse SDH determined on survey and food pantry referral were not associated with preoperative dialysis through TDCs, receiving nonautogenous dialysis access, 30-day ED visits and readmissions, or 90-day mortality.

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Conclusion: Nearly a quarter of dialysis access surgery patients at a safety-net hospital experienced adverse SDH and more than one-third received a food pantry referral. Most common difficulties experienced include difficulty obtaining transportation to medical appointments, food insecurity, and difficulty paying for utilities and medication. Although there were no differences in postoperative outcomes, the high prevalence of these adverse SDH warrants prioritization of resources in this population to ensure healthy equity and further investigation into their effects on health outcomes.

INTRODUCTION

Adverse social determinants of health (SDH) have been known to correlate with increased prevalence of chronic kidney disease (CKD) and other adverse health outcomes. Notably, previous analyses have found factors such as Black race, lower income, lower education, nonprivate insurance, and unstable housing were all associated with higher CKD prevalence and risk of progression to end stage renal disease (ESRD).[1] Regional factors such as neighborhood resources have also been shown to affect ESRD prevalence and mortality.[2,3] Several notable adverse SDH that lead to poor dialysis and transplant outcomes include transportation barriers, poor health literacy, and less social support.[4–6] These effects are seen not only in the United States, but globally as well.[7–10]

Dialysis access creation also poses a factor that may be impacted by adverse SDH in ESRD patients. It is established that autogenous arteriovenous fistulas (AVFs) confer morbidity and mortality benefits over tunneled dialysis catheters (TDCs) and arteriovenous grafts (AVGs).[11–13] However, previous studies have found that factors such as homelessness and insurance status were associated with increased rates of dialysis via TDC prior to autogenous access creation.[14,15] Homelessness has also been associated with increased rates of postoperative readmissions following access creation.[16] Barriers in community-level access to care has also been associated with poor outcomes in dialysis access creation.[17] These findings raise the question as to the total prevalence of adverse SDH within this patient population.

Our institution has implemented an SDH screening survey (titled THRIVE survey) into our electronic health records (EHRs) system which screens for basic needs with high disparity rates in urban families and has been validated in primary care settings.[18,19] The survey is routinely administered by medical assistants in primary care clinics, the emergency department (ED), and medicine specialty clinic visits. Survey responses prompt allocation of supportive resources and tools as needed, including referral to the institution's preventive food pantry. Utilizing these tools and services available at our institution, this study aims to characterize the prevalence of adverse SDH in patients undergoing dialysis access creation and to examine if these adverse SDH lead to differences in health outcomes.

MATERIAL AND METHODS

Data Source

We performed a retrospective cohort study of all patients presenting to our institution for dialysis access creation between 2017 and 2021. Our institution is a large, urban, tertiary safety-net hospital which provides care to a predominately medically-underserved population. Data was collected via chart review. To meet inclusion criteria, patients must have recorded responses to a THRIVE survey within 1-year from their procedure. Currently, THRIVE survey is administered to all patients every 6 months in primary care and medicine specialty clinics. This study was approved by the Boston University Chobanian and Avedisian School of Medicine institutional review board. Requirements for patient informed-consent were waived due to the deidentified nature of this study.

Variables

Survey responses were coded as categorical variables based on responses to the THRIVE SDH screening survey (Supplemental Fig. 1).[18] The THRIVE survey is a custom, institutional SDH screening tool that surveys patients on their unmet social needs in 8 different domains: food insecurity, housing insecurity, transportation insecurity, difficulty arranging child/elder care, ability to pay for utilities, difficulty accessing education resources, employment insecurity, and difficulty paying for medications. Common domains for adverse SDH were originally screened in a pediatric population and then modified for adult patient populations by a multidisciplinary focus group composed of

physicians and patients.[18,19] Additionally, the THRIVE survey serves as a referral tool for various social resources and provides clinicians with a better understanding of their patients' unmet social needs. When implemented in the primary care setting, 22% of patients who screened positive for adverse SDH requested to be connected to further resources, of which 86% received printed referral guides.[18]

In this current study, patients were included if they had THRIVE survey responses within 1 year of operative date. Patients were recorded as a positive screen if they reported any adverse SDH in the above domains. Patients who responded that they are worried about losing their housing in the future, who do not have a steady place to live, or who indicated they were at risk of becoming homeless were categorized as housing insecure. Patients who responded that, in the past 12 months, they often or sometimes ran out of food and did not have enough money to buy more food or were worried of running out of food, or who indicated they needed food for tonight at the time of responding to the survey, were categorized as food insecure. Patients who indicated they were retired were not categorized as unemployed. If patients had multiple THRIVE surveys completed in their chart, the most recent survey to date of operation was used for analysis. History of receiving referral to the preventive food pantry was ascertained from chart review and defined as any previously documented referral to the preventive food pantry within any time frame and was categorized separately from food insecurity on THRIVE survey. Food pantry referral can be prescribed by any physician at our hospital for a patient in need of assistance and was analyzed as an additional indicator of food insecurity.

Covariates for analysis included self-identified demographics (age, gender, race, ethnicity, insurance) and medical comorbidities (diabetes, coronary artery disease [CAD], chronic obstructive pulmonary disease [COPD], hypertension, heart failure, stroke/transient ischemic attack (TIA), atrial fibrillation, hyperlipidemia, and cancer). Covariates were coded as categorical variables, except for age, which was examined both continuously and categorically (age <60, 60−69, 70−79, 80−89, and ≥ 90). Race and ethnicity were both self-identified.

Outcomes

The primary outcomes for this study were examining the prevalence of various adverse SDH and referral to our preventive food pantry within our study population. Secondary outcomes examined the relationship of observed adverse SDH or referral to food pantry with rates of autogenous access versus AVG creation, preoperative TDC use, 30-day ED visits, 30-day readmissions, and 90-day mortality.

Statistical Analysis

Data was summarized as mean and standard deviation for continuous variables and count and percentages for categorical variables. Missing responses to THRIVE questionnaires were excluded from analysis. Univariable analyses were assessed using χ^2 and Fisher's exact tests between cohorts. Multivariable analyses were performed using multivariable logistic regression, adjusting for patient demographics and medical comorbidities as outlined above. Results are represented in adjusted odds ratios with 95% confidence interval. All statistics were performed using Stata version 17.0. $P \leq 0.05$ was considered statistically significant.

RESULTS

There were 677 total patients who underwent hemodialysis access creation during the study timeframe of which 190 patients (28%) had a THRIVE survey response within 1-year of their procedure date. Of these patients, mean age was 60 ± 12 years, 38% were female, 64% identified as Black, 19% identified as Hispanic, and 42% were on Medicaid insurance. Medical comorbidities present in this study population, from most to least prevalent, included: hypertension (93%), diabetes (68%), hyperlipidemia (60%), heart failure (32%), CAD (31%), stroke/TIA (14%), COPD (11%), cancer (9%), and atrial fibrillation (8%). Of arteriovenous accesses created, 39% were brachiocephalic AVFs, 25% were brachiobasilic AVFs, 31% were radiocephalic AVFs, and 14% were AVGs (Table I).

The 4 most prevalent adverse SDH present in this population were difficulty obtaining transportation to medical appointments (18%), food insecurity (16%), trouble paying for utilities (13%), and trouble paying for medications (12%). Remaining adverse SDH assessed on THRIVE were present in less than 10% of respondents, including unemployment (9%), unstable housing (7%), trouble caring for family or friends (6%), and seeking more education (4%). Overall, 42 patients (22%) reported experiencing at least 1 adverse SDH on the survey (Table II). Of these patients, 23 (12%) identified 1 adverse SDH, 6 (3%) identified 2 adverse SDH, 5

Table I. Population characteristics

Covariate	$N = 109$(%)
Demographics	
Age (mean ± SD)	58.8 ± 12.4
Female gender	73 (38.4%)
Race	
White	24 (12.6%)
Black	122 (64.2%)
Hispanic	31 (16.3%)
Asian	7 (3.7%)
Other	6 (3.2%)
Hispanic ethnicity	37 (19.5%)
Insurance	
Commercial	40 (21.1%)
Medicare	69 (36.3%)
Medicaid	80 (42.1%)
AV access type	
Brachiocephalic	74 (39.0%)
Brachiobasilic	48 (25.3%)
Radiocephalic	31 (16.3%)
Brachial-brachial	8 (4.2%)
Lower-extremity fistula	2 (1.1%)
Other fistula	1 (0.53%)
AV graft	26 (13.7%)

SD, standard deviation; AV. arteriovenous.

(3%) identified 3 adverse SDH, 2 (1%) identified 4 adverse SDH, 3 (2%) identified 5 adverse SDH, 1 (1%) identified 6 adverse SDH, 1 (1%) identified 7 adverse SDH, and 1 (1%) identified 8 adverse SDH. A total of 71 (37%) of patients received referrals to the preventive food pantry. With regards to health outcomes, 108 (57%) patients received preoperative hemodialysis via TDC, 44 (23%) patients experienced 30-day ED visits, 39 (21%) patients experienced 30-day readmission, and 4 patients (2%) experienced 90-day mortality.

Two cohort analyses were performed, first looking at patients who identified any adverse SDH on THRIVE survey versus those reporting no adverse SDH, and second looking at patients who obtained a referral to the preventive food pantry versus those who did not receive this referral. Patients with at least 1 adverse SDH identified on survey, compared to patients with no adverse SDH on survey, were less likely to have had a previous failed arteriovenous access (9.5% vs. 30%, $P = 0.006$) or have CAD (14% vs. 35%, $P = 0.01$). Patients with food pantry referral were more likely to be younger than 60 years (61% vs. 38%, $P = 0.013$), were more likely to be of Black race (80% vs. 55%, $P = 0.002$), and were more likely to be on Medicaid insurance (59% vs. 32%, $P = 0.003$). There were no differences in medical comorbidities between patients who received or who did not receive food pantry referrals (Table III). When assessing health outcomes, neither having a reported adverse SDH nor food pantry referral were associated with increased risk of receiving AVG over autogenous access ($P = 0.16$ and $P = 0.37$, respectively), receiving preoperative hemodialysis via TDC ($P = 0.69$ and $P = 0.62$, respectively), 30-day ED visit ($P = 0.6$ and $P = 0.58$, respectively), 30-day readmission ($P = 0.55$ and $P = 0.87$, respectively), or 90-day mortality ($P = 0.89$ and $P = 0.61$, respectively) on both univariable (Table IV) and multivariable (Table V) analyses.

Table II. Adverse social determinants of health noted on THRIVE survey in study population

THRIVE social determinant of health	%
Transportation insecurity	17.8%
Food insecurity	15.8%
Trouble paying for utilities	12.7%
Trouble paying for medication	12.4%
Unemployed/seeking employment	8.9%
Housing insecurity	7.4%
Trouble caring for family/friends	5.7%
Interested in more education	4.5%

DISCUSSION

There were 22% of patients who reported experiencing at least 1 adverse SDH on THRIVE survey, with the most prevalent adverse SDH being transportation insecurity, food insecurity, and difficulty paying for utilities and medications. Referrals to the preventive food pantry were provided to over a third of this study population. Thus, the THRIVE survey and preventive food pantry referrals available at our institution provide unique, granular insight into the exact adverse SDH experienced by dialysis access creation patients.

Our study found that the high rates of adverse SDH experienced by this population were not associated with worse postoperative outcomes at our safety-net hospital with mature social support systems. Neither presence of 1 or more adverse SDH identified on survey nor referrals to the preventive food pantry were associated with the rate of preoperative hemodialysis via TDC, suggesting that adverse SDH did not have a significant association with timing of referral for access creation at our institution. Perioperatively, these factors were not associated with rates of AVG creation over autogenous access, further suggesting that adverse SDH did not influence procedural decisions. Finally,

Table III. Demographics and comorbidities stratified by social insecurity identified on THRIVE survey and food pantry referral

Covariate	No adverse SDH ($N = 148$)	≥1 adverse SDH ($N = 42$)	*P*	No pantry ref. ($N = 119$)	Yes pantry ref. ($N = 71$)	*P*
Demographics						
Age						
<60	66 (44.6%)	22 (52.4%)	0.389	45 (37.8%)	43 (60.6%)	**0.013**
60–69	50 (33.8%)	14 (33.3%)		44 (27%)	20 (28.2%)	
70–79	23 (15.5%)	6 (14.3%)		22 (18.5%)	7 (9.9%)	
80–89	9 (6.1%)	0 (0%)		8 (6.7%)	1 (1.4%)	
Female Sex	58 (39.2%)	15 (35.7%)	0.683	46 (38.7%)	27 (38%)	0.931
Race						
White	18 (12.2%)	6 (14.3%)	0.976	20 (16.8%)	4 (5.6%)	**0.002**
Black	95 (64.2%)	27 (64.3%)		65 (54.6%)	57 (80.3%)	
Hispanic	24 (16.2%)	27 (64.3%)		21 (17.7%)	10 (14.1%)	
Asian	6 (4.1%)	1 (2.4%)		7 (5.9%)	0 (0%)	
Other	5 (3.4%)	1 (2.4%)		6 (5%)	0 (0%)	
Hispanic ethnicity	28 (18.9%)	9 (21.4%)	0.717	22 (18.5%)	15 (21.1%)	0.657
Insurance						
Commercial	31 (21%)	9 (21.4%)	0.776	30 (25.2%)	10 (14.1%)	**0.003**
Medicare	56 (37.8%)	13 (31%)		50 (42%)	19 (26.8%)	
Medicaid	60 (40.5%)	20 (47.6%)		38 (31.9%)	42 (59.2%)	
Other	1 (0.68%)	0 (0%)		1 (0.84%)	0 (0%)	
Comorbidities						
Diabetes	106 (71.6%)	24 (57.1%)	0.075	80 (67.2%)	50 (70.4%)	0.647
CAD	52 (35.1%)	6 (14.3%)	**0.01**	40 (33.6%)	18 (25.4%)	0.232
COPD	15 (10.1%)	5 (11.9%)	0.742	15 (12.6%)	5 (7%)	0.227
Hypertension	137 (92.6%)	40 (95.2%)	0.545	112 (94.1%)	65 (91.6%)	0.498
Heart failure	47 (31.7%)	14 (33.3%)	0.847	40 (33.6%)	21 (29.6%)	0.564
Stroke	22 (14.9%)	4 (9.5%)	0.374	16 (13.5%)	10 (14.1%)	0.901
Atrial fibrillation	14 (9.5%)	2 (4.8%)	0.328	11 (9.2%)	5 (7.1%)	0.616
Hyperlipidemia	91 (61.5%)	23 (54.8%)	0.432	69 (58%)	45 (63.4%)	0.463
Cancer	15 (10.1%)	3 (7.1%)	0.559	12 (10.1%)	6 (8.5%)	0.71
Previous AV access	45 (30.4%)	4 (9.5%)	**0.006**	33 (27.7%)	16 (22.5%)	0.428

≥1 Adverse SDH signifies they responded positive to at least 1 item on the THRIVE SDH screening survey. Bold signifies statistical significance.

SDH, social determinants of health; Ref., referral; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; AV, arteriovenous.

postoperatively, adverse SDH were not associated with increased rates of 30-day ED visits, 30-day readmissions, or 90-day mortality. In contrast, previous literature has argued that race, ethnicity, low socioeconomic status, homelessness, lack of health insurance, low educational attainment, and lack of access to primary care are all associated with decreased rates of initiating dialysis via autogenous access.[14,20–23] One study suggests that these adverse SDH in dialysis access creation may be attributed to access to care issues, in light of the fact that vascular access physicians in the United States are concentrated in neighborhoods with higher white populations, larger proportion of population with high school diplomas, higher per capita income, and greater access to primary care and nephrologists.[24] Our study suggests that adverse SDH may not be associated with inferior surgical health outcomes in all health systems when adequate social support and services are available. Implementation of the THRIVE screening and resource tool within our EHR workflow may contribute to this finding, as it is possible that patients that were identified as a positive screen were able to be plugged into needed social resources.[18,25] Alternatively, it is possible that adverse SDH may affect outcomes not measured in this study. For example, adverse SDH may lead to decreased rates of kidney transplant in this patient population and warrants a topic for future studies.

Although dialysis access creation patients may not experience different outcomes based on exposure to adverse SDH at our safety-net hospital, it is still imperative to acknowledge the prevalence of

Table IV. Univariate outcomes based on social insecurity identified on THRIVE survey and food pantry referral

Outcome	No adverse SDH ($N = 148$)	≥1 adverse SDH ($N = 42$)	*P*	No pantry ref. ($N = 119$)	Yes pantry ref. ($N = 71$)	*P*
Nonautogenous access	16 (10.8%)	8 (19.1%)	0.156	17 (14.3%)	7 (9.9%)	0.374
Preop HD via TDC	83 (56.1%)	25 (59.5%)	0.691	66 (55.5%)	42 (59.2%)	0.619
30-day ED visit	33 (22.3%)	11 (26.2%)	0.598	26 (21.9%)	18 (25.4%)	0.58
30-day readmission	29 (19.6%)	10 (23.8%)	0.551	24 (20.2%)	15 (21.1%)	0.874
90-day mortality	3 (2%)	1 (2.4%)	0.888	3 (2.5%)	1 (1.4%)	0.605

≥1 Adverse SDH signifies they responded positive to at least 1 item on the THRIVE SDH screening survey.
AV, arteriovenous; Preop, preoperative; HD, hemodialysis; TDC, tunneled dialysis catheter; ED, emergency department.

Table V. Multivariable outcomes based on social insecurity identified on THRIVE survey and food pantry referral

Outcome	OR	≥1 adverse SDH 95% CI	*P*	OR	Yes pantry referral 95% CI	*P*
Nonautogenous Access	2.1	[0.74, 5.9]	0.167	0.57	[0.2, 1.6]	0.297
Preop HD via TDC	1	[0.47, 2.2]	0.949	1.1	[0.55, 2.3]	0.758
30-day ED visit	1.3	[0.56, 3.1]	0.522	1.2	[0.53, 2.7]	0.668
30-day readmission	1.4	[0.57, 3.4]	0.462	1.1	[0.45, 2.5]	0.896

Odds ratios were adjusted for age, insurance, race, ethnicity, sex, diabetes, coronary artery disease, chronic obstructive pulmonary disease, hypertension, heart failure, stroke, atrial fibrillation, hyperlipidemia, and cancer.
≥1 Adverse SDH signifies they responded positive to at least 1 item on the THRIVE SDH screening survey.
OR, odds ratio; 95% CI, 95% confidence interval; AV, arteriovenous; Preop, preoperative; HD, hemodialysis; TDC, tunneled dialysis catheter; ED, emergency department.

these adverse SDH experienced by the population, both for allocation of resources and for prevention of adverse outcomes in their ESRD disease course. For example, the most commonly cited disparity within our study was trouble accessing transportation to medical appointments, which undoubtedly serves as a barrier to hemodialysis, where patients are often expected to attend dialysis sessions 3 times a week and may lead to missed appointments. Identification of patients experiencing transportation barriers at the time of access creation may serve as an entry point to being connected to social work for additional resources such as bus tokens and taxi vouchers for medical appointments. The high rates of food insecurity within this population may also pose a challenge to adhering to a renal diet for their ESRD management, compounded with the fact that racial segregation, income inequality, and poor transportation infrastructure have all been associated with decreased access to nutritious food.[26] Identification of food insecurity within dialysis access creation patients may warrant a consult to nutritional services and referral to local food pantry resources or for Supplemental Nutrition Assistance Program benefits. Further, studies should aim to assess feasibility of these interventions in various, diverse health systems and should consider partnering with other departments to develop common infrastructure to support patients with adverse SDH, such as transportation to medical appointments.

There are several limitations to this study. The prevalence of adverse SDH in our study population may be larger than the general population due to this being a single-institutional study at a safety-net hospital and cannot be extrapolated outside this context. We suspect that the prevalence of adverse SDH would be lower than what is reported in this study at nonsafety net hospitals. Additionally, while this is a safety net hospital, the hospital provides many resources for those with adverse SDH, including legal assistance. Institutional allocation of resources to those with adverse SDH may mitigate some of their effect on health outcomes, but the data does not allow for investigation of which patients were connected to resources as a result of the THRIVE survey. Overall, it is possible that our safety-net hospital's mature support systems and increased access to welfare services in New England help decrease health disparities for patients with adverse SDH compared to patients without. Furthermore, the THRIVE survey is based

on patient-reported adverse SDH, which may bias results towards patients who took time to respond to the survey. It is unclear if rates and effects of adverse SDH differ between survey responders and nonresponders. Also, it is possible that adverse SDH may be underreported by some patients. For example, while the rate of reported food insecurity was only 16%, referral rates to the food pantry were much higher. Next, using 1 year as the periprocedural period may not best capture adverse SDH in this population, as socioeconomic circumstances may change during that time. Finally, this study focuses on short-term postoperative outcomes; however, SDH survey responses may be associated with more long-term health outcomes.

CONCLUSION

In our urban, safety-net population of patients undergoing dialysis access creation, there was high prevalence of various adverse SDH, most notably access to transportation, food insecurity, and difficulty paying for utilities and medication. There were high rates of referral to our preventive food pantry. Although presence of these adverse SDH did not affect health outcomes analyzed in our population, acknowledgment of which adverse SDH are most prevalent within dialysis access creation patients may aid in prioritization of resources for this population as we strive to achieve health equity for these patients. Further, analysis in different health-care settings is required to understand the prevalence of adverse SDH in more diverse environments. Future directions for this study will aim to expand implementation of the THRIVE SDH survey within vascular surgery clinics and to pilot interventions to address the high rates of transportation, food, and financial insecurities within this vulnerable patient population.

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SUPPLEMENTARY DATA

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