Urban Social Work, Volume 7, Number 1, 2023

The Impact of Social Determinants of Health on the Identification and Outcomes of Depression in Primary Care

Alissa Mallow[a,b], Ohshue Gatanaga[b], Kristen Miller[c], Melissa Farzam[b], Roni Berger[a] and Virna Little[b]

Social determinants of health (SDOH) may significantly impact treatment outcomes for depression in primary care. An analysis of patients in collaborative care was conducted to explore the association between SDOH and depression baseline scores and treatment outcomes as assessed by the Patient Health Questionnaire-9 (PHQ9). Although individuals' baseline PHQ9 scores did not differ by SDOH flag, there was a direct effect of SDOH on PHQ9 reduction rates. SDOH did not significantly moderate the association between collaborative care treatment and depression outcomes. Individuals flagged with SDOH showed higher depression scores at the end of the treatment despite a higher clinical dosage. Routine screening for SDOH in collaborative care and primary care should be further explored.

Keywords: collaborative care; social determinants of health; depression; mental health; health equity

In 2008, the World Health Organization (WHO) defined social determinants of health (SDOH) as "the conditions in which people are born, grow, work, live, and age and the wider set of forces and systems shaping the conditions of daily life" that create disparities in health outcomes. Social determinants include income security, social connectedness, education, unemployment and job security, food insecurity, and other socioenvironmental factors, which contribute to health inequity (WHO, Commission on Social Determinants of Health, 2008). SDOH may account for up to 50% of health outcomes (Whitman et al., 2022); therein, integration and collection of data on SDOH may be important to allow for the identification and screening of at-risk patients (Gottlieb et al., 2013; Lofters et al., 2017). As a result, it is imperative that connections are made between the identification of social determinants in primary care settings and routine screenings, such as depression screening.

[a]Adelphi University School of Social Work, Garden City, NY, USA
[b]Concert Health, Inc, San Diego, CA, USA
[c]Johns Hopkins University School of Medicine, Baltimore, MD, USA

http://dx.doi.org/10.1891/USW-2022-0012

Addressing SDOH is especially important in primary care settings, as these settings are crucial for reducing health inequity (Basu et al., 2019; Wasserman et al., 2019). Primary care functions to screen at the frontlines and treat the most common health conditions, including cardiovascular diseases, diabetes, depression, and anxiety (Finley et al., 2018). Depression screening has been a requirement for primary care for many years in Medicare, and depression outcomes are a quality reporting requirement for federally qualified health centers (Health Resources & Services Administration [HRSA], 2021). While SDOH screening is not yet required, SDOH has increasingly become a priority for health professionals in recent years, as the National Academies of Sciences, Engineering, and Medicine (2016) recommended that information regarding the 11 SDOH domains be routinely collected and made available in electronic health records Centers for Medicare & Medicaid Services (2021).

Across various populations, the literature underscores the relationship between SDOH and mental health outcomes (Lund et al., 2018). Lower socioeconomic status relating to unemployment and financial insecurity resulted in worse depression outcomes (Remes et al., 2021). Similarly, poverty is associated with an increased prevalence of anxiety disorders (Lund et al., 2010). Among adults, homelessness or inadequate housing correlates to an increased risk of mental disorders in low- and middle-income countries (Lund et al., 2010). However, little research exists linking SDOH to mental health outcomes in primary care settings due to a lack of time and inconsistent screening for mental health and social determinants (Deferio et al., 2019). In lieu of these challenges, team-based approaches in primary care have been proposed in order to better understand and address the SDOH needs of patients (Schottenfeld et al., 2016).

One such team-based approach is collaborative care, which is an evidence-based model with over 80 randomized trials and implementation studies that may be capable of supporting primary care practices in addressing SDOH (Gilbody et al., 2006). Collaborative care traditionally embeds itself in primary care practices to provide behavioral health services for patients with depression and anxiety (Kroenke & Cheville, 2022). Since collaborative care utilizes a cost-effective strategy and focuses on the management and reduction of depression symptoms, it addresses the concerns of primary care practitioners who may prevent screening (Goodrich et al., 2013; Unutzer, 2013). Therefore, this exploratory study seeks to begin the conversation about the impact of SDOH on depression screening and outcomes in primary care settings.

METHODS

Participants, Procedure, and Data Collection

This longitudinal study used secondary data from 18 health centers across the United States from January 2020 to June 2022, garnered from the registry record of Concert Health. All patients were identified as needing behavioral health care by their primary care provider. Site names were kept confidential, and patients' data were de-identified for privacy reasons. After exclusionary criteria were met and missing data were removed, the final analytical sample included 7,800 individuals.

Of these individuals, 106 individuals self-reported SDOH. The study was approved by the Institutional Review Board at Adelphi University IRB#090721.

Assessment

Depressive Symptoms. Depressive symptoms were assessed using the validated Patient Health Questionnaire-9 (PHQ9) item scale (Kroenke & Cheville, 2022). The PHQ9 is a reliable and effective instrument that measures symptoms of depression over the past 2 weeks. It is a nine-item Likert type questionnaire with a four-point response scale (e.g., 0 = not at all, 1 = several days, 2 = over half the days, and 3 = nearly every day). The range of possible scores is 0–27. Scores were divided according to the severity cutoffs as defined by into minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), and severe (20–27) to assess differences in clinical severity for patients with and without SDOH concern.

Social Determinants of Health. SDOH were captured via self-report either during a collaborative care contact with the behavioral care manager or during the primary care visit. Upon disclosure of the SDOH, the patient was asked if they required assistance with the issue, and they were then provided with support and/or referrals. The presence of an SDOH was coded in a binary fashion, with 1 = SDOH flag; 0 = no SDOH flagged.

Statistical Analysis. The final data were analyzed using the statistical software R version 3.6.3 (R Core Team, 2021). Independent *t* tests and χ^2 analyses were performed where appropriate to understand group differences between individuals with an SDOH and those without. A residualized change score was used to understand depression rates over time for participants; this method uses the residuals of the baseline score regressed upon the last score. Variables were checked for normality, and days enrolled (skewness = 1.45) and clinical time (skewness = 2.60) were positively skewed and log-transformed for analyses. Standardized scores were used for continuous variables. PROCESS macro in R v.3.6.3, written by Hayes (2013), was used to conduct moderated mediation analyses in order to understand the interactive effect of treatment and SDOH on changes in depression scores. PROCESS macromodel 15 was used to assess for moderated mediation. It used 5,000 bootstrap replications. The model was deemed significant if the bootstrapped 95% confidence intervals did not cross zero. For all other analyses, significance was set at $\alpha = .05$.

Results

Descriptive Statistics and Correlations. Table 1 shows descriptives, means, and standard deviations between groups of those flagged for SDOH and those not flagged. There was no significant difference in average baseline PHQ9 scores between these two groups ($M_{\text{SDOH}} = 13.32$, $SD = 5.45$; $M_{\text{non-SDOH}} = 12.50$, $SD = 5.83$; $t[7{,}794] = -1.44$, $p = .149$). Despite no difference at baseline, there was a significant difference in average last PHQ9 scores, such that those with SDOH had higher last PHQ9 scores ($M_{\text{SDOH}} = 9.39$, $SD = 6.35$; $M_{\text{non-SDOH}} = 7.20$, $SD = 5.86$; $t[7{,}794] = -3.79$, $p = < .001$). Significant differences in depression scores among the group were assessed using subsets of those flagged for SDOH and those

TABLE 1. Demographic and Clinical Information of the Study Subjects

	Freq. (valid %) or mean (*SD*)			
	Total sample (*n* = 7,800)	SDOH (*n* = 106)	Non-reported SDOH (*n* = 7,694)	*p*-value
Age, years	41.84 (18.60)	47.46 (16.65)	41.76 (18.62)	.002
Enrollment period, days	177.24 (124.92)	215.59 (129.44)	176.71 (124.78)	<.001
Number of contacts, minutes	285.20 (292.92)	369.72 (341.50)	284.03 (292.05)	<.001
Baseline PHQ9 scores	12.51 (5.82)	13.32 (5.45)	12.50 (5.83)	.149
Last PHQ9 scores	7.23 (5.87)	9.39 (6.35)	7.20 (5.86)	<.001
Types of payers				<.001
Medicaid	2,954 (38.1%)	68 (64.2%)	2,886 (37.8%)	
Medicare	1,336 (17.2%)	22 (20.8%)	1,314 (17.2%)	
Commercial	3,460 (44.6%)	16 (15.1%)	3,444 (45.1%)	
Severity of baseline depression symptoms				.353
None-minimal	735 (9.4%)	5 (4.7%)	730 (9.5%)	
Mild	1,757 (22.5%)	23 (21.7%)	1,734 (22.5%)	
Moderate	2,322 (29.8%)	34 (32.1%)	2,288 (29.7%)	
Moderately severe	2,001 (25.7%)	26 (24.5%)	1,975 (25.7%)	
Severe	985 (12.6%)	18 (17.0%)	967 (12.6%)	

not flagged. There was a significant decrease in depression scores within the subset of individuals flagged for SDOH ($t[105] = 6.49$, $p = < .001$) and those not flagged for SDOH ($t[7,689] = 78.74$, $p = < .001$). Figure 1 shows the trajectory of each group's (SDOH and non-SDOH) depression scores from baseline to last score.

Bivariate correlations were conducted across the main study variables (Table 2). The last PHQ9 score was significantly correlated across predictors in an expected fashion; there was a negative association between treatment time—as measured by clinical time in minutes ($r = -.08$, $p < .001$) and enrollment period in days ($r = -.11$, $p < .011$)—and last score. Alternatively, there was a positive correlation between the last PHQ9 score and SDOH ($r = .04$, $p < .001$). The covariate of age showed strong inverse correlations with the last PHQ9 score ($r = -.016$, $p < .001$).

Regression Analyses. In order to assess the impact of SDOH on improvement rates for depression, linear regression models were utilized (Table 3). There was a significant positive relationship between SDOH and the residual change score of depression, holding constant days in therapy, clinical minutes, and age, demonstrating that those with an SDOH showed higher last scores while controlling for baseline scores ($\beta = .42$, $SE = .10$, $p < .001$).

The interactive effect of SDOH and treatment on the direct effect of the enrollment period on the last depression score and on the indirect effect of clinical minutes was assessed through a moderated mediational model. SDOH did not significantly interact with any variables in the pathway (Figure 2); however, the direct relationship between SDOH and the last depression score remained significant even when the interactive variables were added into the model. The moderated mediation index was not significant (index = .03, 95% CI = –.19; .23).

Discussion and Implications for Social Work

This study suggests the need to take into consideration the presence of SDOH in healthcare populations since there may be an impact on last depression scores. In individuals who reported SDOH, there were differences in the average last PHQ9 score between individuals with and without self-reported SDOH. In individuals who self-reported SDOH, PHQ9 scores were higher at the time of discharge despite improvement in depressive symptomatology from the baseline score. This is consistent with existing literature suggesting that social determinants have a cumulative effect on mental health over the lifespan and thus can impact improvement (Allen et al., 2014). Clinicians may wish to consider the need to extend time in treatment for SDOH-affected individuals. At the same time, both behavioral health and primary care providers addressing SDOH may wish to advocate for greater conversation as to how public policies and therapeutic interventions can best address the physical correlates of SDOH, as social policies have considerable influence on how social determinants impact individuals' livelihoods (Shim & Compton, 2018).

The results also indicate a relationship between SDOH and the last depression score, even when interactive variables were added into the model. This suggests the pervasiveness of social determinants, which act as "fundamental causes," thereby impacting patients' mental health outcomes. Although not explored in this study, certain upstream social determinants, like socioeconomic status, are root causes

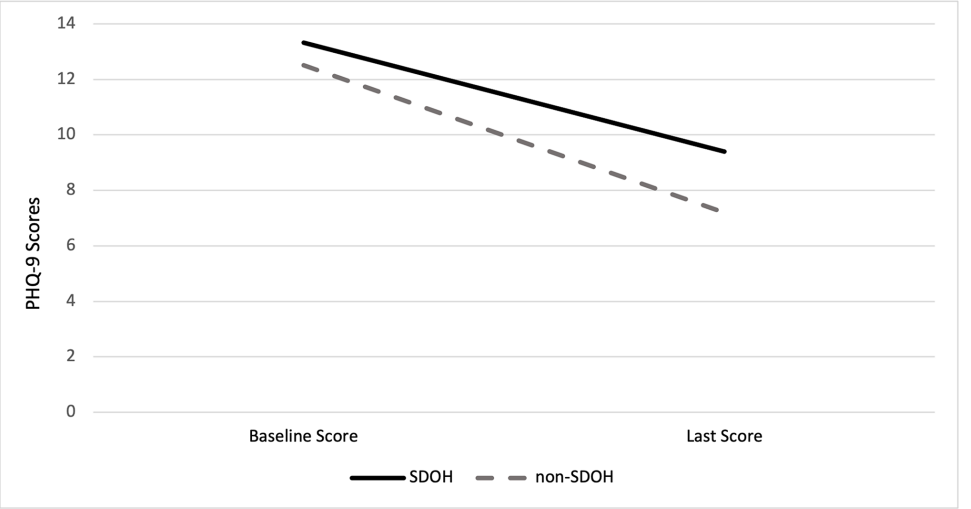

Figure 1. Trajectory of depression scores by group.

influencing other downstream social determinants such as housing, education, insurance status, and access to healthcare (Braveman et al., 2011). While root social determinants have numerous avenues which may impact health outcomes, these results underscore the notion that there exists a direct impact of social determinants on depression outcomes at the end of treatment.

In practice, primary care providers are aware of the direct link between SDOH, psychiatric diagnosis, and physiological health. Therefore, addressing the impact of SDOH on depression scores may be of importance; concurrently addressing these issues can impact the individual's capacity toward becoming more self-efficacious with a greater ability to problem solve. The results demonstrate that individuals with and without SDOH both showed significantly lower rates of depression symptoms at the end of treatment when compared with baseline. As noted by Ridley et al. (2020), treating depression can be an important step toward addressing SDOH considering there is a causal relationship between some social determinants, such as poverty, and common mental illnesses (Ridley et al., 2020). Toward this end, the authors suggest further exploration of collaborative care's effectiveness in supporting individuals with SDOH and improving depression.

While individuals in this study often reported only one SDOH, the reality is that most individuals struggling with SDOH are impacted by numerous factors rather than a single insecurity. For example, when referrals from primary care providers for "transportation" were further explored, other factors such as financial, food, and housing insecurity existed. These factors resulted in a concern regarding the ability to afford transportation to the primary care center, and decisions had to be made by affected individuals on how to maintain housing, food, and medical care financially. In balancing necessities, individuals may not always have the "disposable" income to pay for transportation.

In the economic and social environment in which this article is authored, SDOH continues to become more and more paramount. Primary care and collaborative

TABLE 2. Bivariate Correlations Among Main Study Variables

	Baseline PHQ9	Last PHQ9	Age	SDOH	Enrollment period, days	Clinical time, minutes
Baseline PHQ9	1					
Last PHQ9	.49***	1				
Age	–.06***	–.06***	1			
SDOH	.02	.04***	.036**	1		
Enrollment period, days	–.00	–.11***	–.03	.04***	1	
Clinical time, minutes	.08***	–.08***	–.00	.04***	.70***	1

*$p < .05$; **$p < .01$; ***$p < .001$.

TABLE 3. Linear Regression Models for Collaborative Care Treatment and SDOH on Depressive Symptoms

	Model 1		Model 2		Model 3	
	Beta	*SE*	Beta	*SE*	Beta	*SE*
Intercept	.09**	.03	.09**	.03	.09**	.03
Patient age	–.00***	.00	–.00***	.00	–.00***	.00
Days enrolled	–.05**	.02	–.05**	.02	–.05**	.02
Clinical time	–.11***	.02	–.11***	.02	–.11***	.01
SDOH			.42***	.10	.39***	.14
SDOH × clinical time					.04	.13
SDOH × days enrolled					.04	.14

*$p < .05$; **$p < .01$; ***$p < .001$.

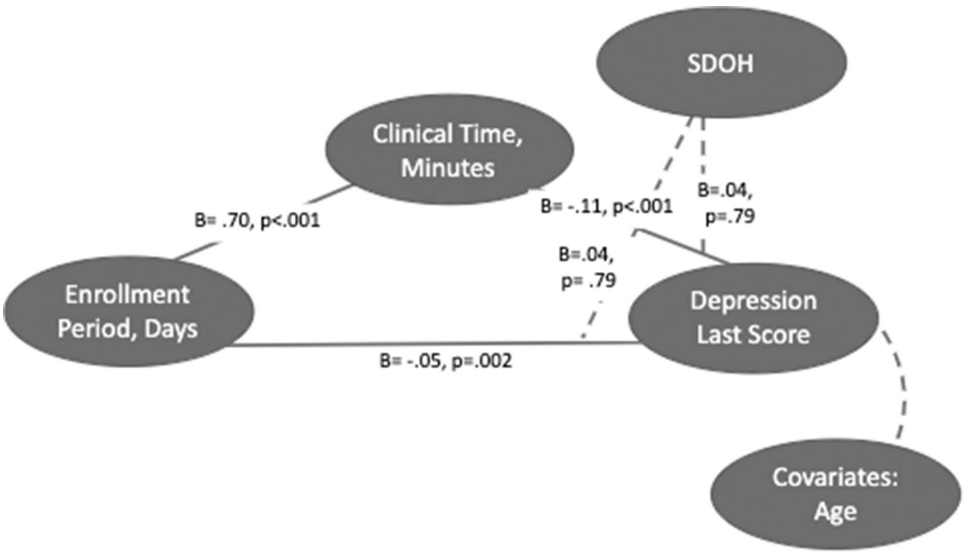

Figure 2. Moderated mediational model.

care are well poised to address not only physical and behavioral health but also population health.

Limitations and Future Directions

Potential limitations to this study are related to the research design, length of the intervention, instrumentation, and participants, all of which present threats to both internal and external validity. The sample size of those with SDOH was small, limiting the overall transferability of the study. Despite the sample size, the impact of SDOH on depression scores was significant, highlighting the importance

of considering SDOH in future studies in collaborative care. Gender, race, and ethnicity were not tracked and therefore not included in the statistical models. Future studies that assess the three-way interactions among gender, SDOH, and changes in depressive symptoms, as well as the relationship between race and ethnicity, SDOH, and depressive symptoms, are warranted.

The final limitation of this particular study is that a validated measure of SDOH was not used when working with patients. Many healthcare providers are not formally screening for social determinants; as a result, many patients are not identified. Using the PRAPARE (Protocol for Responding to and Assessing Patients' Assets, Risks, and Experiences), a nationally recognized and validated tool measuring different domains of SDOH, may lead to the reporting of additional issues with which individuals are confronted (Weir et al., 2020).

In the future, more research should be conducted to understand the impact of SDOH on anxiety outcomes and improvements in the collaborative care model. Several studies have linked the presence of social determinants to poorer anxiety outcomes in various populations (Katz et al., 2018). Additionally, the collaborative care model traditionally assesses behavioral health improvement rates at 90 and 120 days after treatment initiation (AIMS Center, 2022). Our study did not analyze improvement rates of depression at these times, so future studies may benefit from understanding how SDOH impacts time-bound treatment.

While the present study analyzed interaction effects, the small sample size may have impacted the findings. Future studies may benefit from using a larger sample size that allows for better analysis of the interactions between social determinants and other important variables, such as treatment time, age, and severity of depression outcomes. Finally, our study did not analyze the cumulative effects of SDOH, which are noted to have long-term effects on the improvement of mental health outcomes (Allen et al., 2014). Using a validated tool, such as the PRAPARE, and accounting for the presence of multiple SDOH, will better capture how social determinants cumulatively impact individuals' treatment outcomes in collaborative care.

REFERENCES

AIMS Center. (2022). *AIMS Center | Advancing Integrated Mental Health Solutions in Integrated Care*. https://aims.uw.edu

Allen, J., Balfour, R., Bell, R., & Marmot, M. (2014). Social determinants of mental health. *International Review of Psychiatry (Abingdon, England)*, *26*(4), 392–407. https://doi.org/10.3109/09540261.2014.928270

Basu, S., Berkowitz, S. A., Phillips, R. L., Bitton, A., Landon, B. E., & Phillips, R. S. (2019). Association of primary care physician supply with population mortality in the United States, 2005-2015. *JAMA Internal Medicine*, *179*(4), 506–514. https://doi.org/10.1001/jamainternmed.2018.7624

Braveman, P., Egerter, S., & Williams, D. R. (2011). The social determinants of health: Coming of age. *Annual Review of Public Health*, *32*(1), 381–398. https://doi.org/10.1146/annurev-publhealth-031210-101218

Centers for Medicare & Medicaid Services. (2021). *SHO#21-001 RE: Opportunities in Medicaid and CHIP to Address Social Determinants of Health (SDOH)*. https://www.medicaid.gov/federal-policy-guidance/downloads/sho21001.pdf

Deferio, J. J., Breitinger, S., Khullar, D., Sheth, A., & Pathak, J. (2019). Social determinants of health in mental health care and research: A case for greater inclusion. *Journal of the American Medical Informatics Association*, *26*(8–9), 895–899. https://doi.org/10.1093/jamia/ocz049

Finley, C. R., Chan, D. S., Garrison, S., Korownyk, C., Kolber, M., Campbell,, S., Eurich, D., Lindblad, A. J., Vandermeer, B., & Allan, G. M. (2018). What are the most common conditions in primary care? Systematic review. *Canadian Family Physician Medecin de Famille Canadien*, *11*, 832–840.

Gilbody, S., Bower, P., Fletcher, J., Richards, D., & Sutton, A. J. (2006). Collaborative care for depression: A cumulative meta-analysis and review of longer-term outcomes. *Archives of Internal Medicine*, *166*(21), 2314–2321. https://doi.org/10.1001/archinte.166.21.2314

Goodrich, D. E., Kilbourne, A. M., Nord, K. M., & Bauer, M. S. (2013). Mental health collaborative care and its role in primary care settings. *Current Psychiatry Reports*, *15*(8), 383. https://doi.org/10.1007/s11920-013-0383-2

Gottlieb, L., Sandel, M., & Adler, N. E. (2013). Collecting and applying data on social determinants of health in health care settings. *JAMA Internal Medicine*, *173*(11), 1017–1020. https://doi.org/10.1001/jamainternmed.2013.560

Hayes, A. F. (2013). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. The Guilford Press.

Health Resources & Services Administration. (2021). *UDS Manual*. https://bphc.hrsa.gov/sites/default/files/bphc/datareporting/pdf/2021-uds-manual.pdf

Katz, J., Crean, H. F., Cerulli, C., & Poleshuck, E. L. (2018). Material hardship and mental health symptoms among a predominantly low income sample of pregnant women seeking prenatal care. *Maternal and Child Health Journal*, *22*(9), 1360–1367. https://doi.org/10.1007/s10995-018-2518-x

Kroenke, K., & Cheville, A. (2022). Canons of collaborative care. *Journal of General Internal Medicine*, *37*(2), 456–458. https://doi.org/10.1007/s11606-021-06929-9

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ9: validity of a brief depression severity measure. *Journal of General Internal Medicine*, *16*(9), 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Lofters, A. K., Schuler, A., Slater, M., Baxter, N. N., Persaud, N., Pinto, A. D., Kucharski, E., Davie, S., Nisenbaum, R., & Kiran, T. (2017). Using self-reported data on the social determinants of health in primary care to identify cancer screening disparities: Opportunities and challenges. *BMC Family Practice*, *18*(1), 31. https://doi.org/10.1186/s12875-017-0599-z

Lund, C., Breen, A., Flisher, A. J., Kakuma, R., Corrigall, J., Joska, J. A., Swartz, L., & Patel, V. (2010). Poverty and common mental disorders in low and middle income countries: A systematic review. *Social Science & Medicine (1982)*, *71*(3), 517–528. https://doi.org/10.1016/j.socscimed.2010.04.027

Lund, C., Brooke-Sumner, C., Baingana, F., Baron, E. C., Breuer, E., Chandra, P., Haushofer, J., Herrman, H., Jordans, M., Kieling, C., Medina-Mora, M. E., Morgan, E., Omigbodun, O., Tol, W., Patel, V., & Saxena, S. (2018). Social determinants of mental disorders and the sustainable development goals: A systematic review of reviews. *The Lancet. Psychiatry*, *5*(4), 357–369. https://doi.org/10.1016/S2215-0366(18)30060-9

National Academies of Sciences, Engineering, and Medicine. (2016). A framework for educating health professionals to address the social determinants of health. The National Academies Press. https://doi.org/10.17226/21923

R Core Team. (2021). *R: A language and environment for statistical computing. R Foundation for Statistical Computing*. https://www.r-project.org/

Remes, O., Mendes, J. F., & Templeton, P. (2021). Biological, psychological, and social determinants of depression: A review of recent literature. *Brain Sciences*, *11*(12), 1633. https://doi.org/10.3390/brainsci11121633

Ridley, M., Rao, G., Schilbach, F., & Patel, V. (2020). *Poverty, depression, and anxiety: causal evidence and mechanismsscience*. https://doi.org/10.1126/science.aay0214

Schottenfeld, L., Petersen, D., Peikes, D., Ricciardi, R., Burak, H., McNellis, R., & Genevro, J. (2016). Creating patient-centered team-based primary care. Agency for Healthcare Research and Quality.

Shim, R. S., & Compton, M. T. (2018). Addressing the social determinants of mental health: If not now, when? If not us, who? *Psychiatric Services (Washington, D.C.)*, *69*(8), 844–846. https://doi.org/10.1176/appi.ps.201800060

Unutzer, J. (2013). The collaborative care model: An approach for integrating physical and mental health care in Medicaid health homes. *Health Home Information Resource Center*. https://www.chcs.org/media/HH_IRC_Collaborative_Care_Model__052113_2.pdf

Wasserman, J., Palmer, R. C., Gomez, M. M., Berzon, R., Ibrahim, S. A., & Ayanian, J. Z. (2019). Advancing health services research to eliminate health care disparities. *American Journal of Public Health*, *109*(S1), S64–S69. https://doi.org/10.2105/AJPH.2018.304922

Weir, R. C., Proser, M., Jester, M., Li, V., Hood-Ronick, C. M., & Gurewich, D. (2020). Collecting social determinants of health data in the clinical setting: Findings from national PRAPARE implementation. *Journal of Health Care for the Poor and Underserved*, *31*(2), 1018–1035. https://doi.org/10.1353/hpu.2020.0075

Whitman, A., Lew, N., Aysola, V., Zuckerman, R., & Sommers, B. D. (2022). Addressing social determinants of health: Examples of successful evidence-based strategies and current federal efforts. Department of Health and Human Services, Assistant Secretary for Planning and Evaluation, Office of Health Policy. https://aspe.hhs.gov/sites/default/files/documents/e2b650cd64cf84aae8ff0fae7474af82/SDOH-Evidence-Review.pdf

World Health Organization, Commission on Social Determinants of Health. (2008). Closing the gap in a generation: Health equity through action on the social determinants of health. World Health Organization.

Disclosure. The authors have no relevant financial interest or affiliations with any commercial interests related to the subjects discussed within this article.

Funding. The author(s) received no specific grant or financial support for the research, authorship, and/or publication of this article.

Correspondence regarding this article should be directed to Alissa Mallow, Adelphi University School of Social Work, 19 Baker Avenue, Suite 400, Poughkeepsie, New York 12603, United States. E-mail: amallow@adelphi.edu