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Socioeconomic inequality in the outcomes of a psychological intervention for depression for South Africans with a co-occurring chronic disease: A decomposition analysis

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ABSTRACT

Task-shared psychological interventions are effective for reducing the severity of depression symptoms, but differences in treatment outcome by socioeconomic status is uncertain. This study examines socioeconomic inequalities (SEI) in depression outcomes among people with HIV and/or diabetes who participated in a cluster randomised controlled trial in the Western Cape Province of South Africa. The trial took place at 24 primary care clinics randomised to deliver a task-shared psychological intervention or treatment as usual (TAU). The trial enrolled 1119 participants meeting criteria for probable depression. Depression symptom severity was evaluated at baseline and 24-month follow-up. Using a concentration index (CI), SEIs in depression were assessed for the intervention and TAU arms. Demographic and socioeconomic variables were used to decompose the CI to identify contributors to SEI. Results indicate poorer participants at the intervention arm have significantly worse 24-month outcomes than wealthier counterparts (CI = – 0.080; SE = 0.025). Race (34.2%), unemployment (17.4%) and food insecurity (15%) were the main contributing factors. While policymakers need to invest in psychological interventions to reduce the burden caused by depression, this study suggests treatment outcomes may be different across the socioeconomic spectrum. Decomposition of these findings points to structural constraints, such as unemployment, as the key contributors towards poorer treatment outcomes. These findings suggest a need to combine psychological interventions with structural interventions that address the broader socio-economic determinants of mental health.

1. Introduction

Globally, depressive disorders are a leading cause of illness (Vos et al., 2020), impacting 5.0% of the adult population and contributing to 42.5 million disability-adjusted life years (DALYs) lost based on 2019 estimates (Global Burden of Disease Collaborative Network, 2019). More recent estimates indicate a 16.4% increase in DALYs due to the impact of COVID, and depression remains the second leading cause of years lost to disability (Ferrari et al., 2024). Prevalence of depression is highest amongst the poor (Adjaye-Gbewonyo et al., 2016; Burns et al., 2017; Christiani et al., 2015; Hong et al., 2011; Mrejen et al., 2022; Muhammad et al., 2022; Mutyambizi et al., 2019; Sun et al., 2021). It frequently co-occurs with other leading causes of disease burden, such as HIV (C. Bernard et al., 2017; Nakimuli-Mpungu et al., 2012) and diabetes (Nouwen et al., 2019; Yu et al., 2015); and those with depression are less likely to adhere to their chronic disease treatment and experience worse treatment outcomes (Abas et al., 2014; Egede and Ellis, 2010; Nouwen et al., 2019; Regan et al., 2021). Evidence-based psychological treatments can alleviate symptoms of depression in persons with co-occurring health conditions, but questions remain as to the

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effectiveness of these treatments for relatively economically disadvantaged individuals, particularly in low- and middle-income countries (LMICs) (Finegan et al., 2018).

In South Africa, approximately 41% of people living with HIV (Freeman et al., 2008) and between 31% and 46% of people with diabetes (Mashaba et al., 2021; Ramkisson et al., 2016) report clinically significant symptoms of depression. Despite this, only a limited proportion of patients treated for HIV or diabetes are screened for depression and far fewer receive treatment (Sorsdahl et al., 2021). This is largely due to the lack of investment in public mental health services and a chronic shortage of mental health professionals in primary health care settings (Docrat et al., 2019; Sorsdahl et al., 2023). To address this treatment gap, the South African government has implemented a task sharing strategy where community health workers (CHWs) are trained and supervised by mental health professionals to deliver brief, manualized psychological interventions (Raviola et al., 2019; World Health Organization, 2019). While a recent Cochrane review reported that task-shared approaches have promising benefits for depression outcomes (van Ginneken et al., 2021), more evidence is needed regarding the effectiveness of these interventions across the socioeconomic spectrum in LMICs.

Project MIND, a three-arm cluster randomised controlled trial (cRCT), evaluated the effectiveness of two approaches to CHW-delivered psychological treatment for depression, compared to usual care, for people being treated for HIV or diabetes in primary care clinics in the Western Cape, South Africa. This trial demonstrated significant reductions in depression symptoms at 12 months post-enrolment for participants in either intervention approach relative to usual care (Myers et al., 2022).

In this current study, we build on these earlier findings to: (1) evaluate the extent to which this psychological treatment delivered outcomes across the socioeconomic spectrum; and (2) analyse how different socioeconomic and demographic factors contribute to potential socioeconomic inequalities (SEI) in depression outcomes. This study advances the global mental health literature by providing new evidence on SEIs in depression treatment outcomes from a LMIC.

2. Methods

2.1. Study design

This study is part of Project MIND and its extension, MIND-ECON. Details of the Project MIND trial and trial outcomes have been previously reported (Myers et al., 2022). Briefly, 24 co-located HIV and diabetes primary care clinics from the Western Cape Province of South Africa were randomised to (i) a designated arm in which CHWs already working in the chronic disease care team were designated to provide a psychological intervention in addition to their usual chronic disease care responsibilities; (ii) a dedicated arm in which additional CHWs (who had no other chronic disease care responsibilities) were added to the team with the sole responsibility of providing the identical psychological intervention; or (iii) a 'treatment as usual' (TAU) arm in which participants were offered referrals to community-based mental health services. The trial enrolled 1340 participants, with outcomes assessed at baseline, six- and 12-months post-enrolment. Results revealed that the designated and dedicated intervention arms were equally effective, both showing significant reductions in depression symptom severity from baseline to 12-month follow-up relative to TAU (Myers et al., 2022). MIND-ECON, a continuation of Project MIND, added a further assessment of mental health and socioeconomic outcomes at 24 months post-enrolment. Notably, the reductions in depression symptom severity in the intervention arms were maintained at the 24-month endpoint (Jacob et al., 2022).

2.2. Participant recruitment and data collection procedures

During recruitment, health providers screened patients presenting for routine HIV or diabetes care for recent alcohol use and low mood. Individuals reporting any alcohol use in the previous year or low mood in the last fortnight were referred for eligibility screening. Patients were eligible if they were ≥18 years old, taking antiretroviral therapy for HIV or medication for diabetes, had a Centre for Epidemiologic Studies Depression Scale (CES-D) score ≥16 (Radloff, 1977) or an Alcohol Use Disorders Identification Test (AUDIT) score ≥8, and were not receiving mental health treatment. Eligible patients were invited to an enrolment appointment where the study assessor obtained written informed consent for trial participation prior to conducting a computer-assisted baseline assessment in English, Afrikaans, or isiXhosa (the official languages of the province). Self-reported information on socio-demographic factors (age, education, employment, relationship status and frequency of hunger), chronic disease treatment, mental health, and perceived health status were collected. Participants recruited from intervention clinics then received the CHW-delivered intervention. All participants were reassessed at 6-, 12- and 24-months using the same procedures.

2.3. Study variables

2.3.1. Depression

The CES-D score is the dependent variable for the analysis, capturing measures of treatment effectiveness. Validated for use in South Africa (Myer et al., 2008; Pretorius, 1991), the 20-item CES-D measures depression symptoms, with scores ranging from 0 to 60 (Radloff, 1977). Higher scores reflect greater severity of depression, with scores ≥16 indicative of probable depression. Given the focus of this analysis, we restricted the analytic sample to 1119 participants with CES-D scores ≥16 at baseline.

2.3.2. Living standards

We constructed a quantitative wealth index as a measure of household socioeconomic status, given that such measures are easier to collect and less prone to measurement errors than alternatives such as income or consumption in LMIC settings (Sahn and Stifel, 2003). Using baseline data, the wealth index was constructed using multiple correspondence analysis (MCA). Variables included the respondent's housing type (e.g., type of roof, wall, floor), household assets (e.g., car, refrigerator), and basic service access (e.g., water, toilet type) (Howe et al., 2012; Poirier et al., 2020). The baseline wealth index was used for ranking individuals both at baseline and 24-month follow-up. This means that any changes in SEI in treatment outcomes between baseline and 24-months does not account for actual changes in socioeconomic status. Wealth quintiles were tabulated, ranging from 0 (poorest – first quintile) to 4 (least poor – fifth quintile).

Other explanatory variables included biological sex observed at birth (male/female), race (Black African/Coloured),[1] age, educational attainment (completed high school/did not complete high school), location of primary care clinic (urban/rural), partnership status (married or living with partner/single, widowed or separated), employment status (employed/unemployed), household food security (food security/any food insecurity) and housing stability (stable housing/unstable housing). Apart from sex, race, education, and primary care clinic location which were assessed only at baseline, all variables were

[1] The terms Black African and Coloured are official terms used in South African population and census data. "Coloured" refers to people of mixed-race ancestry (Black African, Khoisan, and White). In project MIND, 0.5% of participants did not self-identify as Black African or Coloured. These included 6 individuals who identified as Asian, Indian, or White. For analytic purposes, these were included in the Coloured category.

assessed at baseline and 24 months.

2.4. Analysis

Our analysis measures SEI in depression status at baseline and 24-months within each study arm (TAU, designated, dedicated) and for the combined intervention arm (designated plus dedicated). To accommodate for any bias owing to attrition, we have run our analyses (1) for the full analytic sample (including participants lost to follow-up at 24-months); (2) for the sub-sample of those retained at 24-months; and (3) using multivariate regression to predict the 24-month CES-D score of participants lost to follow-up based on their baseline characteristics.

First, we assess SEI in depression outcomes using a concentration index (Kakwani, 1977; Wagstaff et al., 1991), comparing the distribution of CES-D scores to the distribution of wealth index scores (O'Donnell et al., 2008). We used the following convenient covariance formula (O'Donnell et al., 2008) to define the concentration index (C_h) for individual-level data:

$$C_h = \frac{2}{\mu_h} cov(h, r) \tag{1}$$

where h is the health variable (depression symptoms), μ_h is the mean value of depression symptoms in the study population, $r = i/N$ is the fractional rank of all individuals, and i is the living standards distribution as represented by the wealth index (where N is the total number of participants) with $i = 1$ for the poorest and $i = N$ for the least poor individual. The concentration index varies between -1 and 1 for a quantitative dependent variable, with a negative value indicating a disproportionate concentration of depression symptoms among the relatively poor. A value of zero implies no inequality or an indeterminate relationship between depression symptoms and wealth (O'Donnell et al., 2008).

Second, the concentration indices of each study arm (dedicated, designated, TAU) as well as for the combined intervention arm (dedicated plus designated) were decomposed to identify socioeconomic and demographic factors that explain SEI in depression. The relationship between the CES-D (H) and sociodemographic and economic variables (z_{ki}) associated with the CES-D score is expressed as (Wagstaff et al., 2003):

$$H_i = \alpha + \sum_k \beta_k z_{ki} + \varepsilon_i \tag{2}$$

where α and β are parameters, and ε is the error term.

The concentration index in equation (1) can be re-written as:

$$C_h = \sum_{k=1}^{K} \left(\frac{\beta_k \bar{z}_k}{\mu_h}\right) CI_k + \left(\frac{GC_\varepsilon}{\mu_h}\right) \tag{3}$$

where μ_h is the mean of the CES-D, $\frac{\beta_k \bar{z}_k}{\mu_h}$ is the elasticity of the CES-D score to marginal changes in the k-th explanatory variable, CI_k is the concentration index for the k-th explanatory variable and GC_ε is the generalized concentration index for the error term. The term $\left(\frac{\beta_k \bar{z}_k}{\mu_h}\right) CI_k$ represents the contribution of the k-th explanatory variable to the SEI of depression, and $\frac{GC_\varepsilon}{\mu_h}$, represents the residual component. A negative concentration index on an explanatory variable (CI_k) suggests that the variable (k) is concentrated among the poorest participants.

For all analyses, we computed standard errors using bootstrap methods with 1000 replications controlling for the clustering of participants by study clinics. Data were analysed using Stata software version 15 (StataCorp, 2015).

3. Results

3.1. Descriptive statistics

Table 1 presents the socioeconomic and demographic characteristics of the participants included in the study, providing estimates for the total sample, TAU, designated, dedicated and combined intervention arms. Tests for difference are presented between designated, dedicated and combined intervention arms in comparison to TAU. At baseline, there were 1119 participants with CES-D ≥16. About four out of five participants were female and participants were, on average, 46 years old. Results indicate significant baseline imbalance in proportions of Black African (designated versus TAU; combined versus TAU), participants who completed high school (all intervention arms versus TAU) and CES-D score (all intervention arms versus TAU). In addition, there was a difference in percentage of participants with HIV in dedicated versus TAU. In sTable 1 (supplementary material), baseline descriptive statistics and tests for difference are provided for the subset of participants lost to follow-up at 24-months (N = 262) as well as for those that were retained (N = 857). Findings confirm baseline imbalances on percentage of Black African and participants who completed high school. For the CES-D score, there were baseline differences for the subset retained at 24-months but no significant differences in the subset lost to follow-up.

At 24-month follow-up, 20.9% (TAU arm) and 24.5% (combined intervention arm) of participants were lost to follow up although the difference is not statistically significant (p = 0.311 (sTable 2). Further descriptive statistics of difference in CES-D score by wealth quintiles for each intervention arm compared to TAU arm is presented in sTable 4.

3.2. Socioeconomic inequality in depression

At baseline, there were no significant SEIs in CES-D scores within any study arms (TAU, dedicated, designated and combined intervention arms) (Table 2). In TAU, this finding was maintained at 24 months, but in the dedicated (CI = – 0.083; SE = 0.031), designated (CI = – 0.085; SE = 0.035), and combined intervention arms (CI = – 0.080; SE = 0.025), poorer participants had relatively higher CES-D scores than their wealthier counterparts within the same intervention arm. This result did not change after excluding participants who were lost to follow up or when the analysis was run using predicted CES-D scores for participants lost to follow up, with only small changes in the magnitude of the concentration indices or standard errors.

3.3. Decomposition of socioeconomic inequality in depression outcome

Table 3 illustrates the results from the decomposition of SEI in the 24-month depression outcomes (CES-D score) for the combined intervention arms with sTable 5 and sTable 6 (supplementary material) presenting these results for the designated and dedicated arms, respectively. Results include the concentration indices for each explanatory variable, elasticity of depression outcome with respect to each of the explanatory variables, and the contribution of each explanatory variable to the overall SEI in the depression outcome. The concentration indices of 'food insecure household' (CI_k = – 0.160; SE = 0.039) and 'unemployed' (CI_k = – 0.131; SE = 0.026) indicate that poorer participants were more likely to be food insecure and unemployed. Positive elasticities, for instance, for Black African participants (0.165; SE = 0.044), and urban clinic location (0.327; SE = 0.048) indicate that the 24-month CES-D score was higher (reflecting worse outcomes) among Black African participants and those treated in urban clinics. The 'contribution' column shows the contribution of the explanatory variable to overall inequality in depression outcomes. The sum of the contribution of each explanatory variable indicates that the analysis explains 100% of the inequality. The significant variables that increased SEI in 24-month depression outcomes in the combined intervention arm, to the

Table 1
Demographic and socioeconomic characteristics of the analytic sample at baseline and 24-months.

	Baseline (N = 1119)							
	Total participants (N, %)	Treatment as usual (TAU) arm	Dedicated intervention arm	Difference between dedicated & TAU arm[a]	Designated intervention arm	Difference between designated & TAU arm[a]	Combined intervention arm	Difference between combined intervention & TAU arm[a]
Black African (N, %)[b]	663 (59.25)	274 (80.59)	252 (65.12)	−15.47	137 (34.95)	−45.64**	389 (49.94)	−30.65*
Female (N, %)	901 (80.52)	277 (81.47)	322 (83.20)	1.73	302 (77.04)	−4.43	624 (80.10)	−1.36
Married/living with partner (N, %)	439 (39.23)	134 (39.41)	147 (37.98)	−1.43	158 (40.31)	0.90	305 (39.15)	−0.26
Completed high school (N, %)	128 (11.44)	57 (16.76)	40 (10.34)	−6.42*	31 (7.91)	−8.85**	71 (9.11)	−7.65**
Has stable house (N, %)	855 (76.41)	255 (75.00)	293 (75.71)	0.71	307 (78.32)	3.32	600 (77.02)	2.02
Unemployed (N, %)	627 (56.03)	188 (55.29)	216 (55.81)	0.52	223 (56.89)	1.6	439 (56.35)	1.06
Food insecure (N, %)	399 (35.66)	96 (28.24)	178 (45.99)	17.75	125 (31.89)	3.65	303 (38.90)	10.66
Urban (N, %)	748 (66.85)	236 (69.41)	266 (68.73)	−0.68	246 (62.76)	−6.65	512 (65.73)	−3.67
Age (mean, std. err.)	45.67 (0.37)	45.78 (0.49)	46.36 (0.47)	0.58	47.14 (0.66)	1.36	45.57 (0.55)	−0.21
Has HIV (N, %)	567 (50.67)	163 (47.94)	208 (53.75)	5.81*	196 (50.00)	2.06	404 (51.86)	3.92
Has Diabetes (N, %)	479 (42.81)	133 (39.12)	165 (42.64)	3.52	181 (46.17)	7.05	346 (44.42)	5.3
CES-D score (mean, std. err.)	30.45 (0.87)	27.92 (0.90)	30.85 (0.98)	2.93*	32.26 (1.90)	4.34*	31.56 (1.07)	3.64**
Number of participants		340	387		392		779	
24-month follow up (N = 857)								
Black African (N, %)[b]	500 (58.34)	213 (79.18)	192 (63.58)	0.92	95 (33.22)	5.35	287 (48.81)	−30.37*
Female (N, %)	701 (81.80)	222 (82.53)	253 (83.77)	0.19	226 (79.02)	1.15	479 (81.46)	−1.07
Married/living with partner (N, %)	343 (40.02)	113 (42.01)	114 (37.75)	0.72	116 (40.56)	0.04	230 (39.12)	−2.89
Completed high school (N, %)	102 (11.90)	45 (16.73)	34 (11.26)	1.83	23 (8.04)	5.7**	57 (9.69)	−7.03*
Has stable house (N, %)	748 (87.28)	236 (87.73)	264 (87.42)	0.00	248 (86.71)	0.04	512 (87.07)	−0.66
Unemployed (N, %)	393 (45.86)	128 (47.58)	138 (45.70)	0.23	127 (44.41)	0.46	265 (45.07)	−2.51
Food insecure (N, %)	272 (31.74)	103 (38.29)	104 (34.44)	0.22	65 (22.73)	3.01	169 (28.74)	−9.55
Urban (N, %)	557 (64.99)	179 (66.54)	201 (66.56)	0.00	177 (61.89)	0.03	378 (64.29)	−2.25
Age (mean, std. err.)	48.35 (0.49)	47.32 (0.70)	48.03 (0.74)	0.71	49.66 (0.97)	2.34	48.82 (0.62)	1.50
Has HIV (N, %)	415 (48.42)	128 (47.58)	155 (51.32)	1.49	132 (46.15)	0.20	287 (48.81)	1.23
Has Diabetes (N, %)	378 (44.11)	102 (37.92)	135 (44.70)	3.90	141 (49.30)	11.28	276 (46.94)	9.02
CES-D score (mean, std. err.)	10.91 (0.82)	11.32 (0.75)	10.06 (1.24)	−1.25	11.41 (2.44)	0.09	10.72 (1.25)	−0.60

(*continued on next page*)

Table 1 (*continued*)

	Baseline (N = 1119)							
	Total participants (N, %)	Treatment as usual (TAU) arm	Dedicated intervention arm	Difference between dedicated & TAU arm[a]	Designated intervention arm	Difference between designated & TAU arm[a]	Combined intervention arm	Difference between combined intervention & TAU arm[a]
Number of participants		269	302		286		588	

***, ** Indicate significance at 99% and 95% respectively based on Pearson chi square test or t-test of difference controlling for cluster sampling design.

[a] Pearson Chi-squared or wald test statistics controlling for cluster sample design of the trial.

[b] The terms Black African and Coloured are official terms used in South African population and census data. "Coloured" (reference category) is a neutral term in South Africa that refers to people of mixed-race ancestry (Black African, Khoisan, and White) who have their own cultural identity.

Table 2
Socioeconomic inequalities in depression symptom severity by study arm at baseline and 24-months.

	Concentration index (SE)						
	a. Baseline: including attriters (N = 1119)	b. Baseline: excluding attriters (N = 857)	c. 24-months (N = 857)	d. 24- months including predicted CES-D (N = 1119)	Difference: c versus a	Difference: c versus b	Difference: d versus a
Treatment as usual (TAU) arm	−0.008 (0.009)	−0.003 (0.009)	0.027 (0.031)	0.027 (0.033)	0.035 (0.033)	0.029 (0.034)	0.035 (0.034)
Dedicated arm	−0.008 (0.009)	0.002 (0.010)	−0.083 (0.032)**	−0.083 (0.031)**	−0.075 (0.034)**	−0.085 (0.033)**	−0.075 (0.032)**
Designated arm	0.003 (0.009)	0.003 (0.010)	−0.085 (0.033)**	−0.085 (0.035)**	−0.089 (0.034)***	−0.088 (0.037)**	−0.089 (0.036)**
Combined intervention arm	−0.001 (0.006)	0.004 (0.007)	−0.080 (0.024)***	−0.080 (0.025)***	−0.079 (0.024)***	−0.084 (0.025)***	−0.079 (0.026)***

***,** Indicates significance at 99% and 95% confidence intervals respectively based on bootstrap standard errors with 1000 replications controlling for cluster sample design.

Table 3
Decomposition of the concentration index for 24-month depression outcomes among participants in the combined intervention arm.

Variable	CI	SE		Elasticity	SE		Contribution	SE		% contribution
Black African	−0.166	0.025	***	0.165	0.044	***	−0.027	0.008	***	34.2
Female	−0.015	0.013		0.058	0.078		−0.001	0.002		1.0
Food insecure household	−0.160	0.039	***	0.075	0.029	**	−0.012	0.006	**	15.0
Completed high school	0.137	0.073	*	−0.008	0.012		−0.001	0.002		1.4
Unemployed	−0.131	0.026	***	0.106	0.037	***	−0.014	0.006	**	17.4
Age	0.055	0.006	***	0.278	0.203		0.015	0.011		−19.0
Married	0.061	0.029	**	−0.017	0.032		−0.001	0.002		1.3
Has stable house	0.047	0.010	***	0.026	0.115		0.001	0.005		−1.5
Second quintile	−0.470	0.025	***	−0.015	0.028		0.007	0.013		−8.9
Third quintile	−0.078	0.026	***	−0.021	0.027		0.002	0.002		−2.0
Fourth quintile	0.330	0.025	***	−0.025	0.030		−0.008	0.010		10.3
Fifth quintile (least poor)	0.772	0.025	***	−0.040	0.031		−0.031	0.024		38.6
Urban	−0.024	0.018		0.327	0.048	***	−0.008	0.006		9.8
Has HIV	−0.221	0.024	***	−0.129	0.132		0.029	0.030		−35.7
Has Diabetes	0.246	0.025	***	−0.127	0.119		−0.031	0.030		39.0
Explained contribution							−0.078	0.026	***	97.6
Residual							0.002	0.004		2.5
Concentration index of depression							−0.080	0.023	***	100.0

***, **, * Indicate significance at 99%, 95% and 90%, respectively based on bootstrap standard errors with 1000 replications. Standard errors are not adjusted for clustering due to inadequate sample sizes for some of the characteristics of respondents in some clusters.

[a]First quintile (poorest) is the reference category.

disadvantage of the poorer, were race (Black African), employment status (being unemployed), and household food security (being food insecure), accounting for 34.2%, 17.4%, and 15.0% of the concentration index of depression, respectively. The results were similar for the designated arm, with differences in magnitude (sTable 5) while age and race were the significant contributors to inequality in the dedicated arm (sTable 6). sTable 7 provides the decomposition of the 24-month SEI in depression outcomes at the combined intervention sites based on a binary outcome variable using a CES-D cutoff of 16. Results are similar to that of Table 3 with a slightly higher value in the concentration index (−0.136; SE = 0.039). Furthermore, sTables 8-10 present decomposition results using the predicted CES-D score for those lost to follow-up.

4. Discussion

There is substantial LMIC evidence that depression is more prevalent

among the poor (Adjaye-Gbewonyo et al., 2016; Burns et al., 2017; Mutyambizi et al., 2019) and socioeconomically disadvantaged populations are less likely to receive mental health treatment (Borges et al., 2020; Evans-Lacko et al., 2018). Should they receive treatment, a smaller body of literature shows poorer mental health treatment outcomes among the socioeconomically disadvantaged population (Cohee et al., 2020; Elwadhi and Cohen, 2020; Falconnier, 2009; Finegan et al., 2020; Finegan et al., 2018). Our study extends this literature by assessing socioeconomic inequalities (SEI) in depression outcomes 24 months after the receipt of a task-shared psychological intervention. This intervention has been shown to be effective in reducing the severity of depression compared to TAU (Myers et al., 2022), consistent with the existing literature (van Ginneken et al., 2011).

In this current study, we find no evidence of SEI in depression at baseline, but at 24-months follow-up there is evidence of worse treatment outcomes in the relatively poor in the intervention arms. A similar pattern is not found in participants receiving TAU. Our finding of SEI in treatment outcomes persists when we restrict our analysis to those retained at 24 months and when we use a regression technique to predict the CES-D score in those lost to follow-up. However, baseline imbalance between study arms indicates that some caution is needed when interpreting these findings.

Our study contributes to an existing literature that shows worse mental health treatment outcomes among populations with lower socioeconomic status (Cohee et al., 2020; Elwadhi and Cohen, 2020; Falconnier, 2009; Finegan et al., 2018). This literature indicates worse outcomes in the poor treated with antidepressants (Elwadhi and Cohen, 2020); in those treated for anxiety (Jakubovski and Bloch, 2016); in depression treatment among cancer patients (Cohee et al., 2020); and other mental health conditions (Birmaher et al., 2009). In addition to individual socioeconomic status, living in deprived neighbourhoods is also associated with increased mental health problems and poor treatment outcomes (Kivimäki et al., 2020; Kleineberg-Massuthe et al., 2023; Lorant et al., 2018; Finegan et al., 2020; Firth et al., 2023; Missiuna et al., 2021). For instance, a study in England showed recovery rates of mental health varying between 8.2% and 86.6%, with people from poorer areas having lower recovery rates (Delgadillo et al., 2016a). Another study (Kleineberg-Massuthe et al., 2023) in Germany compared socioeconomic differences in depression and psychosocial impairment at admission and discharge based on social milieus. While mental health improved for all at discharge, higher rates of symptoms and impairment were found in patients from lower class backgrounds. In contrast, a systematic review of psychotherapy for common mental health problems based on 17 studies indicated some evidence for an inverse relationship between SES and treatment outcomes, but findings were inconclusive due to differences in measurement of SES (e.g., income, education, employment status, neighbourhood deprivation) (Finegan et al., 2018). Similarly, a few studies assessing SES as a moderating variable of mental health treatment outcomes found inconclusive results (Cheng et al., 2019; van der Wal et al., 2020). While the previous literature has used various regression methods (e.g. multiple regression, random effects, multilevel regression) or between group statistical tests, the advantage of using a concentration index is that it provides the magnitude of inequality in treatment outcomes for the entire population rather than groups (Wagstaff, 2000).

Based on the decomposition of the CI of 24-month CES-D, our results indicate that Black African race, unemployment and food insecurity were the factors estimated to be the significant contributors to inequality in depression outcomes to the disadvantage of the poorer. These results hold when disaggregating the combined intervention arm into designated or dedicated arms, when the analysis is restricted to those retained at 24-months or when we predict the 24-month CES-D in those lost to follow-up.

While inequality and poverty are distinct concepts, they are interlinked in various ways (Bundy, 2020). In South Africa, despite differences between poverty and inequality, it is impossible to consider one in the absence of another (Francis and Webster, 2019). The apartheid legacy of exclusion persists benefiting those who always had access to opportunities while the disadvantaged remain in poverty, effectively passing inequality down through generations (Bundy, 2020; de Villiers, 2021). Unemployment and food insecurity are proxy indicators for poverty, which is known to cause psychological distress (Albee, 2006; Joffe, 1996) and contribute to feelings of inadequacy and hopelessness (Smith et al., 2012), increasing risk of depression (Dohrenwend et al., 1992). Race is also a proxy for socioeconomic deprivation and is correlated with inequality in South Africa (World Bank, 2022). In comparison to other population groups, the Black African population experiences higher socioeconomic deprivation, likely due to the persisting effects of apartheid discrimination (Chibba and Luiz, 2011; Philip, 2012). As South Africa has chronically high unemployment (Ngwakwe and Iqbal, 2021; Statistics South Africa, 2021), psychological interventions may not yield sustained mental health benefits due to the persistence of these structural socioeconomic stressors (Nakimuli-Mpungu et al., 2020).

One way to address this SEI in depression outcomes is for future research to consider the distributional effects of psychological interventions when designing, implementing, and evaluating interventions (Arundell et al., 2020). Interventions with the greatest population health gain might be accompanied by an unintended increase in mental health inequalities. In terms of future intervention design, multilevel interventions that target the causes of health disparities by focusing not just on the individual level, but wider social, economic or policy factors, may help strengthen the effects of psychological interventions. RCTs need to "employ sampling methods that ensure ample representation of individuals from a wide range of social worlds" (Elwadhi and Cohen, 2020). However, these interventions are complex and pose challenges in terms of implementation and sustainability (Alegria et al., 2021). In terms of intervention evaluation, in contexts with high SEI like South Africa, consideration of health inequalities can be included through distributional cost-effectiveness analysis (Cookson et al., 2017). Equity impact assessment tools can further help prioritise interventions that are most likely to be effective in reducing mental health inequalities (Olyaeemanesh et al., 2023).

Another way to address the SEI in outcomes is to address mutable inequalities in employment and food security. Our findings suggest that eradicating inequalities in employment and food (in)security would lower SEI in depression outcomes by 17% and 15% respectively. This highlights the importance of addressing the social determinants of mental health in South Africa, which include the social factors that determine mental health and inequalities in the distribution of these social factors (Graham, 2004). Investment in initiatives that address the social determinants of mental health in this context (e.g. increasing the number of employment opportunities) as well as initiatives that reduce inequalities in the distribution of these social determinants (e.g., reducing socioeconomic disparities in employment opportunities) (Graham, 2004; Islam, 2019) are needed to ensure population-level improvements in the distribution of mental health benefit. As our findings confirm a social gradient in mental health, where people at the lower end of the social and economic hierarchy experience worse treatment outcomes (Alegría et al., 2018; Delgadillo et al., 2016b), efforts to reduce these inequalities need to occur across the entire social gradient.

Taken together, study findings and the existing literature suggest that people who are the most socioeconomically disadvantaged and at greatest risk for depression are unlikely to experience the full benefits of psychological interventions unless these interventions are accompanied by structural interventions to reduce socioeconomic disadvantage. Our findings are a call to implement multicomponent interventions that carefully consider and evaluate distributional impacts and combine psychological interventions with structural interventions that address SEI. Evidence-informed structural interventions that have shown positive effects on inequalities in mental health outcomes include generous

welfare benefits (Shah et al., 2021), employment benefits, improved housing and neighbourhood environment, and gender equality policies (Delgadillo, 2018; OECD, 2021). Without co-investment in these structural interventions, psychological interventions may lead to mental health improvements for individuals with less socioeconomic hardship, however the most disadvantaged are likely to be left behind, perpetuating the vicious cycle between inequality in socioeconomic status and inequality in mental health.

Given the scale of SEI in South Africa, and the already significant fiscal burden associated with existing state social welfare and poverty alleviation programmes (Mtapuri and Tinarwo, 2021; World Bank, 2022), the South African government is unlikely to have the financial or human resource capabilities to implement structural interventions without significant co-investment and collaboration with the private sector and civil society. Furthermore, redistributive policies that aim at reducing poverty may reduce inequality but only in the short run (Bourguignon, 2018). While the debate on whether poverty drives inequality or vice versa and how to tackle them continues (Bourguignon, 2018; Francis and Webster, 2019), policy makers can look to the HIV (Mayosi et al., 2012) and COVID-19 pandemics (Adepoju, 2020; Cleary et al., 2021) where the public and private health sectors along with civil society worked together to enhance access to and outcomes of healthcare for the greater good. Similar intersectoral collaboration with a 'whole of society approach' and 'whole of government approach' is needed to address SEI in mental health.

Our study has several limitations. While our results were robust with respect to the findings on SEI in depression and the decomposition of the concentration index across the different treatment arms, the data revealed the potential for risk of bias arising from attrition and baseline imbalance. In terms of attrition, we were able to show that our results were sustained when we excluded participants lost to follow-up or when we predicted the CES-D in those lost to follow-up. However, our analysis could not overcome issues of baseline imbalance between study arms. This means that the pattern we find of worse treatment outcomes in the poor in contrast to equivalent outcomes in those receiving TAU may have been due to factors other than the receipt of the intervention. A further limitation is that we used a wealth index to assess living standards. While this approach is often used in LMICs where it is difficult to collect accurate income or expenditure data, the wealth index may not necessarily proxy current living standards (O'Donnell et al., 2008). Finally, project MIND recruited participants from clinics located in poor communities. As such the sample does not reflect the full spectrum of socioeconomic status (excluding middle class and wealthy individuals).

5. Conclusion

This study provides new evidence of inequalities in mental health outcomes 24 months after receipt of a psychological intervention in a LMIC setting. Decomposition of these findings points to structural constraints, such as unemployment, as being key contributors towards these poorer treatment outcomes. These findings indicate a need to adapt or tailor psychological treatments so that they might benefit the relatively poor and to combine these interventions with structural interventions that address the broader socio-economic determinants of mental health.

CRediT authorship contribution statement

Amarech Obse: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Susan Cleary:** Writing – review & editing, Validation, Funding acquisition, Conceptualization. **Rowena Jacobs:** Writing – review & editing, Funding acquisition, Conceptualization. **Bronwyn Myers:** Writing – review & editing, Funding acquisition, Data curation, Conceptualization.

Reflexivity statement

The authors include four females span multiple levels of seniority. Three of the authors are health economists, one mid-career and two senior researchers with expertise in health economics research. The senior author is public mental health specialist with extensive expertise in developing, implementing, and evaluating mental health interventions including expertise in the social determinants of mental health. All authors have experience working in the Global South.

Consent for publication

Not applicable.

Ethics approval and consent to participate

This study was approved by the University of Cape Town (089/2015 and 186/2019), Western Cape Department of Health (WCDoH) (WC2016_RP6_9), the South African Medical Research Council (EC 004-2/2015), and Oxford University (OxTREC 2-17).

Declaration of generative artificial intelligence in scientific writing

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2024.117659.

Abbreviations

CES-D	Centre for Epidemiologic Studies Depression Scale
CHW	community health worker
CI	concentration index
LMIC	low- and middle-income countries
SEI	socioeconomic inequalities
TAU	treatment as usual

Data availability

The authors do not have permission to share data.

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