Effects of household member mortality on mental health: evidence from South Africa

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Abstract

Background: The burden of disease associated with mental disorders in low- and middle-income countries has received heightened attention in the past decade, but there is limited evidence on factors shaping mental health outcomes in these countries. Moreover, despite the high mortality rates in sub-Saharan Africa, little is known about the effect of household member mortality on mental health outcomes of those who survive. We use longitudinal data from South Africa to study trends in mental health and assess the effects of household member mortality on depression scores of surviving household members.

Data and Methods: We use four waves of longitudinal data collected between 2008-2015 as part of the National Income Dynamics Study to assess the effect of household-level mortality events on the presence of depressive symptoms, as measured by the 10-item Center for Epidemiologic Studies Depression (CES-D) scale. We examine how CESD-10 scores, and proportion with scores >10, the cutoff for depression, of individuals aged ≥15 years are affected in the period after the death of a household, controlling for time trends and a range of socio-demographic characteristics. We also examine whether depression scores are affected prior to mortality events, particularly since AIDS-associated mortality was common during the study period. We also estimate individual-level fixed effects models that compare within-person changes over the four survey waves.

Results: From 2008 to 2015, the proportion of adults in South Africa meeting the threshold for depression fell substantially from 27% to 17%. Individuals in households that experienced a death in the past 6 months and 7-12 months had CES-D scores that were 0.42 ($p<0.01$) and 0.49 ($p<0.01$) higher (worse) than individuals in households with no deaths in the past 24 months, whose mean CES-D score was 5.78. This effect was equivalent to a 4 percentage point increase in CES-D scores above the cutoff for depression, a relative increase of 14%. The results also provide suggestive evidence that mental health outcomes of individuals deteriorate during the 24 month period prior to the death of a household member.

Conclusions: This study is among the first to examine the relationship between the death of household members and mental health of surviving household members in a setting with high rates of adult mortality due to HIV/AIDS and other factors including interpersonal violence and road traffic accidents. Our findings show a strong association between mortality events in a household and worse mental health outcomes among surviving household members but also indicate a large secular decline in the prevalence of depressive symptoms since 2008 that warrants further investigation.

Introduction

The burden of disease associated with mental disorders in low- and middle-income countries has received heightened attention in the past decade (Whiteford, Degenhardt et al. 2013). While mental disorders have historically been seen as rare in sub-Saharan Africa (SSA), they are now considered to be highly prevalent in the region (Tomlinson, Swartz et al. 2007). The Global Burden of Disease Study estimated that mental and substance use disorders account for 19% of disability-adjusted life years in SSA (Whiteford, Degenhardt et al. 2013), with depressive disorders being the most common.[1] Unlike the robust evidence base from high-income countries, however, there is only limited evidence from SSA on factors shaping mental health outcomes – an evidence gap that stems from a lack of population-based data as well as challenges in identifying causal pathways.

Deaths resulting infectious diseases and a host of other factors including armed conflicts, crime, and road traffic accidents have the potential to harm a wide range of outcomes of surviving household members, including their mental health. There are several pathways through which loss of kin may affect mental health outcomes. These include direct effects through bereavement (now recognized as a pathway to clinical depression in psychiatry's Diagnostic and Statistical Manual, Version 5) but also indirect effects through changes in household wealth and consequent economic burdens. Yet despite the high mortality rates in SSA, there is strikingly little evidence from the region on how mortality has affected population-level mental health outcomes. The HIV epidemic presents a case in point, as some socio-economic consequences of HIV morbidity and mortality have been widely studied and a robust policy response including HIV prevention and treatment has helped reduced AIDS deaths significantly. Few studies, however, have assessed the effects of mortality in high HIV prevalence settings on mental health outcomes of surviving individuals.

Several studies outside SSA have used longitudinal data to examine how economic crises, natural disasters, and stressful life events such as loss of kin influence mental health outcomes (Norris, Murphy et al. 2004, Frankenberg, Friedman et al. 2008, Friedman and Thomas 2009) . However, the distribution of such events is vastly different in SSA due to a greater burden of infectious diseases such as HIV/AIDS, tuberculosis, and malaria. South Africa represents an important setting in which to study patterns the effects of mortality on mental health outcomes. Despite growing access to life-prolonging antiretroviral therapy (ART), South Africa has the world's largest epidemic, with 7.2 million infected individuals (18.8% adult prevalence rate) and 110,000 AIDS deaths in 2017 (UNAIDS 2017). In addition, mortality rates due to violent crime and other injuries are high in South Africa, with road traffic accidents and interpersonal violence each accounting for approximately 5% of deaths (IHME 2016). The

[1] Findings from the South African Stress and Health study (SASH), the National Income Dynamics Study (NIDS), and smaller studies elsewhere suggest that adults in SSA have comparable or higher prevalence of depression than their counterparts in other countries (Ardington and Case 2010; Hamad et al. 2008; Rochat et al. 2011; Tomlinson et al. 2007).

country's population also has a high prevalence of mental disorders. The South African Stress and Health study found a lifetime and 12-month prevalence of mental disorders among adults of 30.3% and 16.5%, respectively(Stein, Seedat et al. 2008, Herman, Stein et al. 2009) and other studies report high prevalence of depression symptoms(Hamad, Fernald et al. 2008, Rochat, Tomlinson et al. 2011). To our knowledge no studies have used population-based longitudinal data from SSA to study mental health trajectories and to investigate how they are affected by mortality of family members.

Data limitations have been a key reason for the limited evidence base on the effects of mortality on mental health outcomes in SSA. Prior research has largely relied on cross-sectional datasets or small samples and studied the association between mental health and a limited set of demographic characteristics. Few nationally representative surveys from SSA have included measures of mental health. Existing studies have primarily examined correlations between mental health and factors such as age, gender, education, and income.[2,3]

Apart from the prominent influence that household member mortality may have on mental health outcomes, South Africa is also an important setting in which to study mental health outcomes due to its high rates of income inequality and the existence of various social protection programs intended to reduce health and economic disparities. South Africa has had persistent socio-economic, urban-rural, and racial gradients in access to care and health outcomes (Ataguba, Akazili et al. 2011, Mayosi and Benatar 2014, McLaren, Ardington et al. 2014). Poverty, education, access to public services, and exposure to violence, which are important social determinants of health, are likely to influence mental health. Partially in response to these inequalities, the South African government has introduced several high profile cash transfer programs in the post-Apartheid era, including a disability grant directly targeting HIV-positive individuals as well as old age pensions and child support grants that may impact health directly and indirectly. While evidence suggests that cash transfers can improve mental health (Haushofer and Shapiro 2016, Kilburn, Thirumurthy et al. 2016), few studies have assessed whether programs like South Africa's have protective effects on mental health outcomes, and whether they mitigate the likely impacts of household member mortality on depressive symptoms.

This paper makes use of longitudinal data from South Africa that span a 7-year period between 2008-2015 in order to examine the trends in mental health and the effects of household

[2] Cross-sectional data from some surveys in South Africa have shown that depression scores are higher among women and those with low education (Ardington and Case 2010; Herman et al. 2009).

[3] A larger evidence base from developing countries also shows that mental ill health interacts in a negative cycle with poverty (Das et al. 2007; Lund et al. 2011; Patel and Kleinman 2003). Hypotheses for this relationship include the possibility that poverty is associated with higher stress, social exclusion, and exposure to trauma; and conversely that mental illness increases the poverty risk due to reduced productivity and higher health expenditures.

member mortality on mental health outcomes of surviving individuals. We first present a descriptive analysis of the trends in depressive symptoms in South Africa since 2008, which demonstrate both a significant decline and convergence between various groups. We then assess the effects of household member mortality using multivariate regression, including with individual fixed effects, to compare mental health outcomes between households that did and did not experience a mortality event, as well as the within-person variation in mental health before and after a household mortality event. Finally, we examine heterogeneity in the effects of deaths of household members and evaluate the effects of cash transfer programs on mental health.

Methods

Data and sample

We use from the National Income Dynamic Study (NIDS), a longitudinal population-based cohort in South Africa. The NIDS data consist of four survey waves, conducted every 2 years between 2008 and 2015 (Leibbrandt and Woolard 2016). NIDS followed a panel of individuals sampled at baseline and obtained data on income, labor supply, migration, self-reported health, and children's education. Household members of individuals who were originally sampled were also surveyed in each wave. In addition, household-level data on outcomes such as wealth, household shocks, household composition and structure, were collected in each survey wave. NIDS also assessed depressive symptoms for all household members aged ≥15 years during each wave. The sample for this study consists of all individuals for whom a score on the measure of depression is available, and who were included in at least one NIDS survey wave. For some analyses, we restrict the sample to those who were observed in each of the first 3 waves.

Measurement of exposure and outcome

In this study, the exposure of interest is a death in an individual's household in the past 2 years. Deaths in a household are assessed by self-report in a household roster module, which records deaths of all household members in the 24 months leading up to the survey. Household members are defined as those who usually sleep in the household for at least four nights per week. The month and year of death as well as the sex, age, and relationship to the head of household of the deceased person are recorded.

The outcome of interest is the presence of depressive symptoms, as measured by the 10-item Center for Epidemiologic Studies Depression (CES-D) scale. The 10-item scale is a shortened version of the 20-item CES-D, and the 10-item shorter version has been validated in the South Africa in Zulu, Xhosa, and Afrikaans. Each of the 10 items assesses symptoms of depression experienced in the past week, such as "I was bothered by things that usually don't bother me" and "My sleep was restless." Questions are scored on a Likert scale (0) Rarely or none of the time; (1) Some or little of the time; (2) Occasionally or moderate amount of time; (3) all of the

time. Scores are the sum of the responses to the 10 items, and range from 0 to 30 with higher scores indicating more severe symptoms. Scores greater than 10 indicate depression.

The CESD-10 is widely used to evaluate depressive symptoms around the world (Cheng and Chan 2005). It has relatively high sensitivity (0.82, 95% CI 0.73–0.87) for predicting depression if the 10-item scale has a score >10 (Tsai 2014). In a validation exercise in South Africa, alternative thresholds of CES-D score >12 and >13 were recommended for higher specificity in the African and Asian groups (Baron, Davies et al. 2017). Because of the different cutoffs recommended across race groups in South Africa, we use the continuous measure in our main model to assess the continuous increase/decrease of depressive symptoms, and assess the proportion meeting the threshold for clinical depression as a secondary outcome.

Statistical analyses

We estimated the association between a mortality episode in the household and average CESD-10 score using linear regression. We compared the CESD-10 scores between individuals who experienced a death in their household and those who did not, controlling for a range of baseline socio-demographic characteristics including gender, age, race, household wealth, and geographic area (District council).

The main model we estimated had the linear CESD-10 score as the outcome, and a set of four binary indicators for mortality events in the past 0-6, 7-12, 13-18, and 19-14 months. We include controls for baseline household characteristics (wealth, size), survey wave, and an indicator for whether there will be any deaths in the household in the future survey periods. We cluster standard errors at the PSU level to reflect the sampling design of the survey. We repeat this analysis and include individual fixed effects, instead of control variables, to remove variation due to fixed personal characteristics and thus compare within-person changes before and after a household death.

We conducted several subgroup analyses, by estimating regressions by subgroup according to the respondent sex, race, income status, and whether the death was unanticipated (violence, auto accident) vs. anticipated (illness), and occurred in a child vs. an adult. We also carried out a series of robustness and sensitivity analyses. First, we restricted our sample to only individuals who are observed in waves 1, 2, and 3 in order to ensure that results are not driven by individuals who leave the sample. We used a binary outcome (CES-D score>10) to measure changes in the proportion of individuals who meet the criteria for depression, in addition to the continuous measure of the severity of symptoms. We also use a semi-parametric regression to capture the time patterns, to assess sensitivity to the estimation method and break down the 24-month period by years and quarters (vs. 6 month periods in the main analysis) to assess sensitivity to the coding of the exposure variable. To check the robustness of the results and non-parametrically estimate a p-value, we use a permutation test.

Results

Prevalence of depressive symptoms in South Africa

Figure 1 displays the distribution of CESD-10 across the four survey waves. The mean decreases from 8.05 to 6.64 from wave 1 to wave 4, as reflected in the leftward shift of the score distribution. A score of 10 or higher indicates depression, and during the study period the proportion of the population in South Africa meeting this threshold falls substantially from 27% to 17%. Figure 2: CESD score by gender Figure 3, and Figure 4 display trends in CES-D scores over time, by gender, race, and income quintile. These figures similarly show a decline in CES-D scores and a convergence between groups.

The sample characteristics are displayed in Table 1. The sample is 66% female and mostly African (84%). A majority have finished primary school, and 37% were employed at the time of the survey. Over the study period, household deaths decline, as shown in Table 2. The proportion of individuals who experienced a death in the household falls from 15.30 to 9.24 over the same period.

Results: Effect of household member mortality on mental health outcomes

In a longitudinal analysis of mortality in a household and CES-D scores of the surviving household members, mortality is associated with worse mental health outcomes. Table 3 presents the association between deaths in a household in the past 24 months and CES-D score, both with controls for a range of individual and household-level characteristics and with individual-level fixed effects. The effect is positive and significant, with larger effect sizes in the 12 months immediately prior to the survey wave. Individuals in households that experienced a death in the past 0-6 months and 7-12 months have a CES-D score that is 0.42 ($p<0.01$) and 0.49 ($p<0.01$) points higher on average than individuals in households with no deaths in the past 24 months. Table 4 shows results from the same analysis with the binary outcome for CES-D greater than 10, the clinically-relevant level indicating depression. The estimates are equivalent to a 4 percentage point increase in CES-D scores above the cutoff for depression, a relative increase of 14%.

To eliminate many sources of potential bias from individual- or household-level characteristics that may lead to both higher mortality risk among household members and higher CES-D scores, we estimated fixed effects models that included indicator variables for each individual (see columns 3 and 4 in both Table 3 and Table 4). This allows a comparison between an individual's mean CES-D score in survey waves that were preceded by a household death, relative to the same individual's mean score in survey waves where there was no household death. Individuals in households that experience deaths may also more likely to have higher CES-D for reasons that are not easily measured, such as social isolation or other environmental factors, and co-morbidity of depression and other illnesses. We find that the effect size estimates from the primary analysis do not persist when we include individual fixed effects. This is likely due to the slow change in CES-D over time and the combination of both anticipatory

and post-mortality effects on CES-D, which means that there is insufficient within-person variation to detect rapid changes in CES-D between survey waves.

To further understand the association between mortality and depressive symptoms, and to provide evidence about whether it is likely to approximate the causal effect of household mortality on CES-D scores, we carried out several subgroup analyses. First, to evaluate whether the association measured is likely to be biased due to the co-morbidity of illnesses that lead to death and depression, we restrict our analysis to instances where the death was unanticipated (ie due to a road accident or violence, as opposed to a disease where the mortality risk would be known in advance), and find no association between mortality in the past 12 months and CES-D scores among unexpected deaths which suggests that deaths due to illness impact mental health outcomes differently or that different groups are exposed to unexpected deaths compared with deaths from illness.

Second, we conduct subgroup analyses by gender, income, and race, to assess whether socio-economic factors could be the cause of both depression and household deaths. In the main results we did include controls for baseline wealth and for racial group, but by restricting to sub-groups that are likely to be similar on SES we obtain estimates for those particular groups and compare these with the association among the full population. Figure 5 shows that the results of subgroup analyses by income, race, and gender are similar to the main model's estimates. We also assess the effect among deaths occurring in children, and find a similar, but less precise, effect size estimate.

Finally, we assess the interaction between mortality events and receipt of any cash transfers from the government (old age pension, child grant, or disability grant), to measure whether the cash transfers have a protective effect. Table 5 shows that the coefficients on the interaction between mortality events and cash transfers are negative in the period preceding the death, suggesting a possible protective effect during a period of illness leading up to the death, but that they are not significant. *The analyses of the effect of cash transfers on mental health are preliminary and will be extended in subsequent versions of this paper.*

Discussion

While a large body of research has explored the effects of child and adult mortality in SSA on a range of socio-economic outcomes, this paper is among the first to examine the effects of mortality on mental health outcomes of surviving household members. The results show that in South Africa, which has the largest HIV/AIDS epidemic in the world and high rates of mortality, deaths of household member result in large and significant increases in depression scores as assessed by a widely-used scale. We provide evidence that there are negative mental health effects in the period preceding a death, suggesting that the burden of an ill household member negatively impacts mental health of other household members. We also explore whether there are any protective effects of South Africa's cash transfer programs, and do not find a strong effect.

This study assesses how the effect of mortality on mental health outcomes differs by characteristics of the household (wealth), the deceased person (age, cause of death), and the surviving members (gender, race, income). We find that the effect of mortality is very similar across these groups, indicating that while the levels vary substantially across these groups their response to a mortality event is quite similar.

In addition to documenting that mortality events within households impact depressive symptoms, this study also highlights a striking improvement in mental health outcomes over the 7-year period between 2008-2015 during which data were collected. This reduction in depressive symptoms is concentrated among groups with worse outcomes in 2008, resulting in a reduced gradient across gender, race, and income level. Poor mental health is an important contributor to the global burden of disease. Research on depression and other mental health problems has largely been limited to rich-country contexts, despite some evidence indicating that the problem is as or more important in developing countries. In this study, we use the only longitudinal surveys from SSA that measures mental health, which allows us to quantify levels and trends from 2008-2015. One important implication from this study is that the large decreases in mortality that have occurred in SA, thanks in part to the provision of ART, may be linked to important population-level reductions in depressive symptoms. This is an important and overlooked benefit of ART and underscores the importance of treating HIV not only for the direct benefits to patients but also for the benefits to their families and communities.

This study has strengths and limitations. We use longitudinal data to estimate the effect of deaths in a household on depressive symptoms. The large dataset allows for detailed subgroup analyses, which allows us to estimate the association between mortality and CES-D scores among various subgroups. Because our data spans a 7-year time period, we can also show descriptively that there has been a large decline in depressive symptoms in SA since 2008. We use a well-validated measure of depression that has specifically been evaluated in the South African context. However, there is still potential for bias in the estimates presented here, due to unmeasured confounding by individual and household-level characteristics. We cannot measure changes in CES-D in the very short term, since surveys are every 2 years, so we may not accurately capture the time trends in CES-D if changes happen immediately and then adjust relatively rapidly. Our estimates may be somewhat attenuated by the longer time horizon for measurement.

This study demonstrates that there has been substantial improvements in mental health outcomes in South Africa during the past decade. As outcomes have improved, so have the gaps between black and white, and rich and poor, such that inequality in depressive symptoms has also reduced. Further, we provide evidence that there is a significant association between household-level mortality events and increased depressive symptoms, suggesting that the striking improvement in mental health outcomes may be attributable in part to reduced mortality rates that have in turn been driven by the concurrent expansion of HIV prevention and treatment intervention. Further analysis is needed to more directly examine the

population-level mental health impacts of policy responses to the HIV epidemic as well as other programs such as cash transfers.

Table 1: Sample characteristics

Sample characteristics for NIDS wave 1 (2008)	
Variable	**Percentage or mean (SE)**
Female	66.87
Age	38.07 (16.95)
African	84.17
No schooling	13.46
Some primary	18.36
Complete primary/some secondary	46.82
Complete secondary	13.46
Any higher education	7.73
Employed	37.45
Monthly income (ZAR)	3741 (6030)

Table 2: Panel description

Panel characteristics for NIDS waves 1-4				
	Wave 1	**Wave 2**	**Wave 3**	**Wave 4**
Number of observations	15,556	16,740	18,617	22,710
Proportion with any HH death (past 24m)	15.30	11.77	10.00	9.24
Mean CES-D score (95% CI)	8.05 (7.98-8.13)	7.07 (7.00-7.13)	6.83 (6.76-6.89)	6.64 (6.59-6.70)

Table 3: Household mortality is associated with higher CES-D scores

	(1)	(2)	(3)	(4)
Model	Simple model	With individual and HH controls	With individual fixed effects	With individual fixed effects and control for future HH death
	Outcome: CES-D score			
Female		0.55***		
		(0.046)		
Race (Ref: Black)				
Coloured		-1.06***		
		(0.202)		
Asian		-2.21***		
		(0.327)		
White		-1.74***		
		(0.232)		
Age (in years)		0.04***		
		(0.002)		
Household size		-0.01		
		(0.012)		
Wave (Ref: 2008)				
2010	-1.01***	-1.01***	-0.99***	-1.03***
	(0.145)	(0.140)	(0.145)	(0.146)
2012	-1.15***	-1.05***	-0.98***	-1.04***
	(0.127)	(0.124)	(0.129)	(0.130)
Household experienced death in a future wave				0.38*
				(0.218)
Death occurred 19-24m prior	0.1	-0.09	-0.58**	-0.68***
	(0.206)	(0.200)	(0.249)	(0.255)
Death occurred 13-18m prior	0.48**	0.09	0.25	0.15
	(0.204)	(0.198)	(0.273)	(0.282)
Death occurred 7-12m prior	0.73***	0.49***	0.14	0.04
	(0.193)	(0.188)	(0.264)	(0.271)
Death occurred 0-6m prior	0.72***	0.42***	0.3	0.21
	(0.172)	(0.163)	(0.237)	(0.243)
Death occurs 0-6m in future (anticipatory effect)	0.44*	0.31	0.02	0.15
	(0.235)	(0.223)	(0.284)	(0.291)
Death occurs 7-12m in future (anticipatory effect)	0.15	-0.03	-0.05	0.04
	(0.212)	(0.205)	(0.285)	(0.284)

Death occurs 13-18m in future (anticipatory effect)	0.76***	0.57***	0.69***	0.80***
	(0.222)	(0.197)	(0.264)	(0.276)
Death occurs 19-24m in future (anticipatory effect)	0.49**	0.27*	0.14	0.23
	(0.200)	(0.185)	(0.239)	(0.246)
Asset count		-0.13***		
		(0.010)		
Constant	7.95***	5.78***	7.96***	7.91***
	(0.107)	(0.308)	(0.081)	(0.087)
Number of observations	43641	43596	43641	43641
R2	0.017	0.118	0.02	0.02
Number of individuals in fixed effects models			20104	20104
District council indicators	N	N	Y	N
Standard errors in parentheses, asterisks indicate p-values: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the PSU level. Models include data from first three waves of NIDS. Column 2 includes indicators for District Council (location).				

Table 4: Household mortality associated with larger proportion of individuals with CES-D>10, indicating depression

	(1)	(2)	(3)	(4)
Model	Simple model	With individual and HH controls	With individual fixed effects	With individual fixed effects and control for future HH death
	Outcome: Indicator for CES-D>10			
Female		0.04***		
		(0.004)		
Race (Ref: Black)				
Coloured		-0.05***		
		(0.014)		
Asian		-0.11***		
		(0.026)		
White		-0.09***		
		(0.016)		
Age (in years)		0.00***		
		(0.000)		
HH size		0		
		(0.001)		
Wave (Ref: 2008)				
2010	-0.09***	-0.08***	-0.09***	-0.09***
	(0.013)	(0.012)	(0.013)	(0.013)
2012	-0.07***	-0.06***	-0.06***	-0.06***
	(0.011)	(0.011)	(0.011)	(0.011)
Household experienced death in a future wave				0.03
				(0.021)
Death occurred 19-24m prior	-0.01	-0.01	-0.04*	-0.05**
	(0.017)	(0.016)	(0.021)	(0.022)
Death occurred 13-18m prior	0.02	0.0	0.02	0.01
	(0.018)	(0.018)	(0.026)	(0.026)
Death occurred 7-12m prior	0.05***	0.04**	0.01	0.01
	(0.016)	(0.016)	(0.024)	(0.025)
Death occurred 0-6m prior	0.04***	0.02	0.02	0.01
	(0.015)	(0.015)	(0.021)	(0.021)
Death occurs 0-6m in future (anticipatory effect)	0.04*	0.03	0.02	0.03
	(0.022)	(0.022)	(0.029)	(0.030)
Death occurs 7-12m in future (anticipatory effect)	0.01	0.0	0	0.01
	(0.019)	(0.020)	(0.026)	(0.027)
Death occurs 13-18m in future (anticipatory effect)	0.07***	0.06***	0.07***	0.08***
	(0.020)	(0.019)	(0.026)	(0.027)
Death occurs 19-24m in future (anticipatory effect)	0.03*	0.02	0	0.01
	(0.018)	(0.017)	(0.024)	(0.02

Asset count		-0.01		
		(0.001)		
Constant	0.27***	0.17***	0.27***	0.26***
	(0.008)	(0.022)	(0.007)	(0.008)
Number of observations	43641	43596	43641	43641
R2	0.01	0.035	0.013	0.013
Number of individuals in fixed effects models			20104	20104
District council indicators	N	N	Y	N
Standard errors in parentheses, asterisks indicate p-values: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the PSU level. Models include data from first three waves of NIDS. Column 2 includes indicators for District Council (location).				

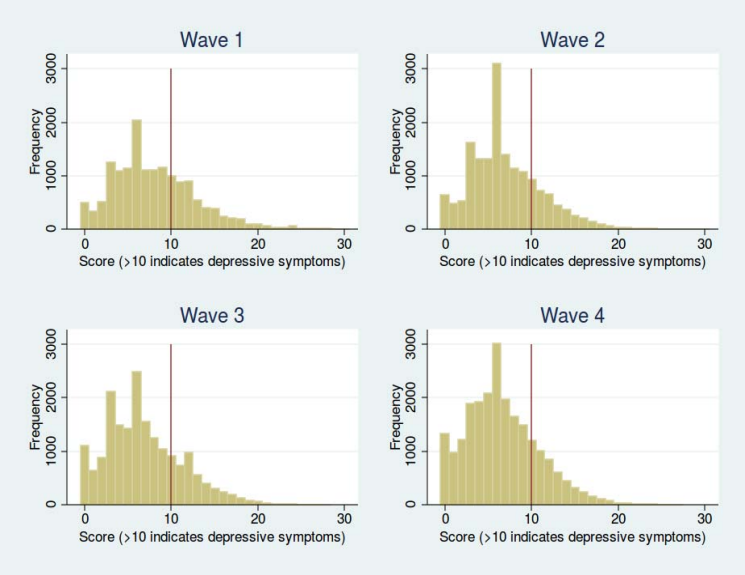

Figure 1: Distribution of CES-D scores by survey wave

Figure 2: CESD score by gender

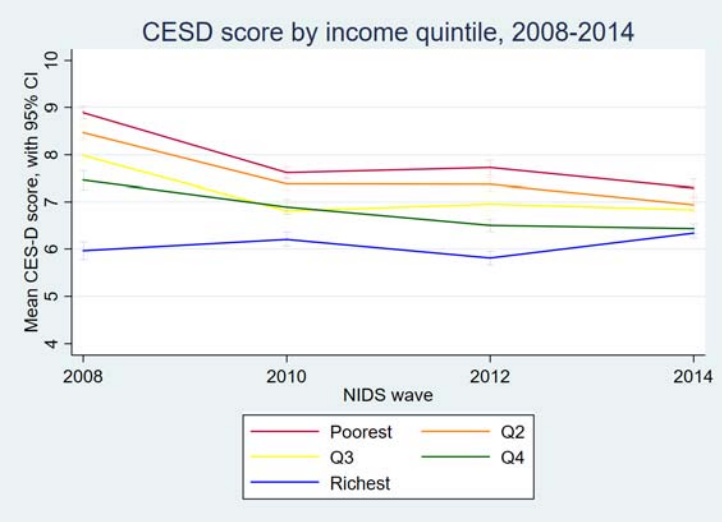

Figure 3: CESD score by income quintile

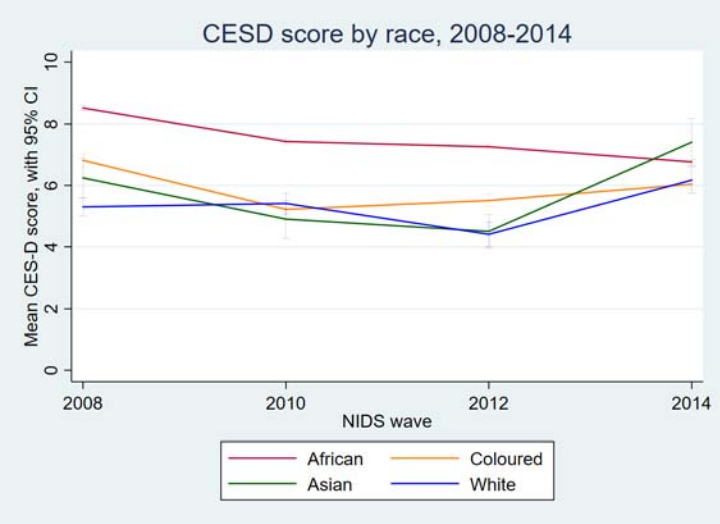

Figure 4: CESD score by race

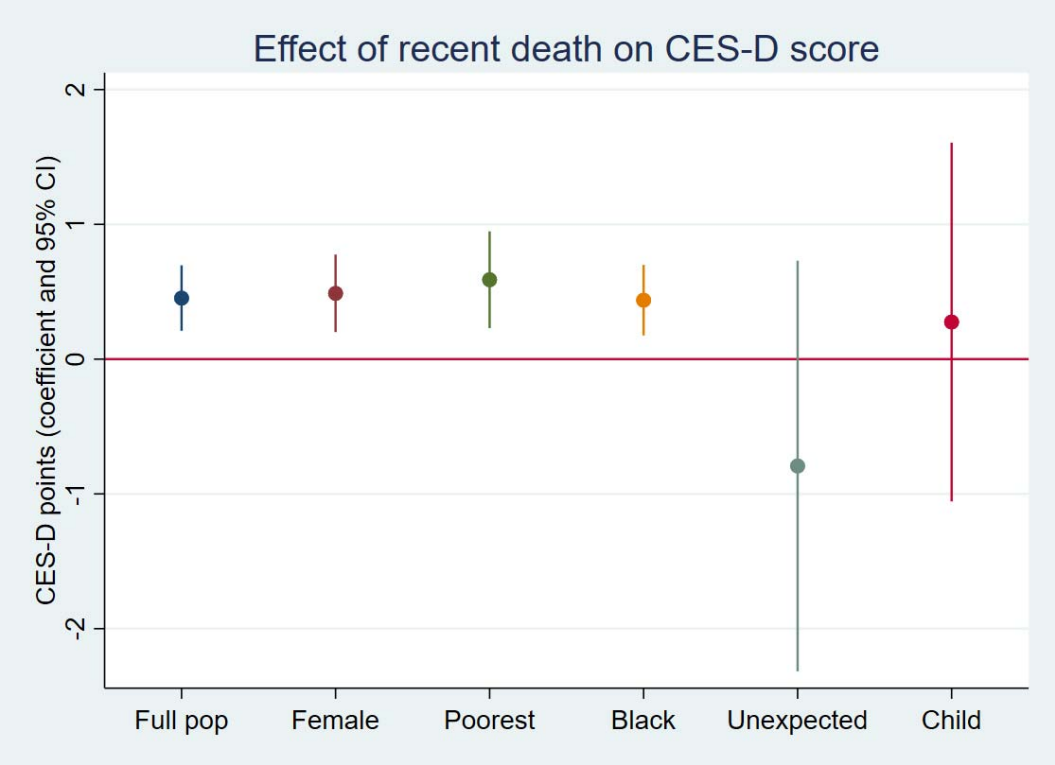

Figure 5: Comparison of coefficients across subgroup regressions

This figure compares the effect of a death in the prior 12 months on CES-D scores among various subgroups relative to the full study population. Subgroups include: Female, poorest (lowest income quartile), Black South Africans, deaths that were unexpected, and deaths among children (<15 years of age). All models include the same set of household and individual controls as in tables 3 and 4 (age, race, wealth, household size, wave dummies, and district council fixed effects. Standard errors are clustered at the PSU level.

Table 5: Protective effect of cash transfers on CES-D score following mortality event

	Effect on CES-D score
Any cash transfer	0.39***
	(0.056)
Death occurred 13-24m prior	0.18
	(0.141)
Death occurred 13-24m prior X cash transfer	-0.08
	(0.179)
Death occurred 0-12m prior	0.46***
	(0.122)
Death occurred 0-12m prior X cash transfer	0.18
	(0.174)
Death occurred 0-12m after (anticipatory)	0.37*
	(0.169)
Death occurred 0-12m after X cash transfer	-0.28
	(0.266)
Death occurred 12-24m after (anticipatory)	0.53***
	(0.183)
Death occurred 12-24m after (anticipatory) X cash transfer	-0.04
	(0.229)
Constant	6.92***
	(0.121)
Observations	59622
R-squared	0.069
Standard errors in parentheses, asterisks indicate p-values: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the PSU level. Model includes controls for baseline SES as shown in tables 3 and 4.	

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