Extended Abstract Submission: "Cash Transfers and Cognitive Health: Evidence from South Africa"

Introduction

Cognitive health of aging populations in low/middle income counties (LMICs) is a growing concern for policy makers. By 2040, over 70% of the world's dementia burden will come from these settings.[1] The institutional capacity of LMICs to cope with this rising burden is limited, particularly because much of their aging population is poor, has low educational attainment, resides in rural areas, and lacks access to health insurance, pension programs, and savings.

Thus, an important question to explore is whether public policy that extends health insurance or raises incomes (to name two examples) can affect cognitive health. Despite the importance of this question, extant research is lacking. This paper will explore how unconditional cash transfers, *vis-a-vis* a non contributory pension, can affect cognitive aging in rural South Africa. While I consider only one setting in this paper, these types of pension/transfer programs are widespread and varied around the world. An important piece of the discussion will focus on the external validity of the results.

Old Age Grants in South Africa

The program at the focus of this paper is South Africa's Old Age Grant (OAG), which has existed since the 1940s. However, for most of the program's history it excluded the majority of the country's population that is black. This changed in the past two decades as efforts were made to extend eligibility to these populations. The pension pays approximately twice the median household income among the rural, black population and is often the largest single source of income for a given household.[2] Both men and women become eligible at age 60.

Previous research on the OAG shows its potential to improve health and quality of life, but no papers have examined cognitive health explicitly. Recently, Gordon and Miller (2012) find improvements in self rated health and improved mortality outcomes, but these results are sensitive to estimation strategy.[3] Work from Anne Case analyzes the effects of the pension program on self rated health, but only makes limited inference because of small sample sizes. [4] No prior work to my knowledge has assessed health outcomes such as cognition, nor its correlates or determinants (discussed below).

Income and Cognitive Health

Whether cash transfers can improve adult/old age cognitive health is not well established. There are only a handful of studies and they find conflicting results.[5] Studies which show cash transfers

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[1] Ferri et al. (2005.) Global Prevalence of Dementia: A Delphi Consensus Study. *The Lancet*.

[2] Case & Deaton. (1998). Large Cash Transfers to the Elderly in South Africa. *The Economic Journal.*

[3] Gordon & Miller. (2012). The South Africa Pension Program and the Health of the Elderly and Their Families: Regression Discontinuity Evidence from October Household Surveys. Working Paper, UC Davis.

[4] Case. (2004). Does Money Protect Health Status? Evidence from South Africa's Pension. In Perspectives of the Economics of Aging. University of Chicago Press.; Case, Lee, & Paxon. (2007). Does Money Empower the Elderly? Evidence from the Agincourt Demographic Surveillance Area. *Scandinavian Journal of Public Health.*

[5] See: Aguila & Casanova. (2018). "Cognition and Income in Old Age." *Health Policy and Planning*; Ayyagari & Frisvold. (2016). "The Impact of Social Security Income on Cognitive Functioning at Older Ages." *American Journal of Health Economics*; Cheng et al. (2015). "The Health Implications of Social Pensions: Evidence from

improve cognitive health suggests this is because of they improved food security, healthcare utilization, and lower levels of stress and depressive symptomatology. These are all important pathways that link income to cognitive health: food security may improve nutritional intake and stress; better healthcare utilization can help individuals manage chronic cardiovascular diseases like diabetes and hypertension that are known to be detrimental to cognition, and decreasing stress and depression can increase cognitive reserve and cognitive functioning.[6]

Data and Outcomes

I analyze several outcomes using wave 1 of HAALSI ("Health and Aging in Africa: a Longitudinal Study of an INDEPTH Community in South Africa"). The survey was fielded among 27 villages in the Agincourt district, close to the border with Mozambique, between 2014 and 2015. The survey was designed to study the health and wellbeing of aging South Africans, and includes individuals ages 40 and over.

The primary outcome of interest is cognitive functioning. I examine a global score as well as individual components, all validated for the low income, low educational attainment setting.[7] These components are: immediate and delayed word recall, a numeracy exercise, and a measure of orientation that asks the respondent to recall the date and day of the week. Second, I analyze important correlates of cognitive health to explain the underlying mechanisms improving cognition, like depression (CESD-9), life satisfaction, subjective social status, and self rated health. While I focus on these outcomes to explain the results, I also examine a variety of other possible mechanisms like healthcare utilization, food security, and markers cardiovascular disease like body mass index and blood pressure. I find no results for these outcomes, however.

Empirical Strategy

Since decisions to take-up the OAG are endogenous with the outcomes of interest, I rely on a differences in differences approach to identify the effect of the cash transfer on cognition. Specifically, I exploit variation *across* villages in the propensity to take up the OAG and variation *within* villages between OAG-eligible and OAG-ineligible ages (the eligibility cut off is age 60). The reduced form equation is:

$$Y_{iv} = \eta_v + \beta_1 \mathbb{I}(Age_i \geq 60) + \beta_2 \big(\mathbb{I}(Age_i \geq 60)\big) \times Takeup_v) + X_{iv} + \nu_{iv}$$

Y_{iv} is the outcome of interest (e.g., cognitive health), and η_v is a village-fixed effect. The parameter of interest is β_2, which is the coefficient for the interaction term between $\mathbb{I}(Age_i \geq 60)$, a dummy variable for being age 60 and over, and the village-level take-up rate of the OAG, $Takeup_v$. Since β_2 is the reduced from coefficient, it represents the intent to treat estimate (ITT). The model also includes a vector of village, household, and individual level covariates (X_{iv}) and their interactions with $\mathbb{I}(Age_i > 60)$ and $Takeup_v$. ν_{iv} is a heteroskedactic

China's New Rural Pension Scheme." Working Paper, IZA; Novella & Olivera. (2014). "Mental Retirement and Pensions for the Elderly in Peru." Working Paper, KU Leuven.

[6] For a review of socio-economic determinants of cognition, see: McEwen and Gianaros. (2010)."Central Role of the Brain in Stress Adaptation: Links to Socioeconomic Status, Health and Disease." *Proceedings of the New York Academy of Sciences*.

[7] Humpfries et al. (2015). Cognitive Function in Low-Income and Low-Literacy Settings: Validation of the Tablet-Based Oxford Cognitive Screen in the Health and Aging in Africa: A Longitudinal Study of an INDEPTH Community in South Africa (HAALSI). *Journal of Gerontology, Series B.*

robust error term, clustered at the village level and orthogonal to the village fixed effects.[8]

The underlying assumption is that differences in cognition between OAG-eligibles and ineligibles across villages are attributable only to differences in take-up of the pension cash transfer (conditional on X_{iv}). The village fixed effect absorbs any (un)observables at the village level that may bias this estimate. I will also show that this approach differences out many of possible confounders at the household and individual level, such as height and educational differences, that may correlate with the take-up rate. This estimation strategy is not without limitations, and I will take care to address them more fully in the conference paper.

Preliminary Results

I present these results from the reduced form equation in the table below. I find that the cash transfer improves cognitive health, but only certain domains related to short term memory. This is largely consistent with medical literature on the subject, and the null results for orientation and numeracy serve as a placebo check for my results.[9] I argue the improvements in cognitive health are because of declining stress, as proxied by depression and life satisfaction.

	(1) Word Recall	(2) Orientation	(3) Numeracy	(4) Depression	(5) Life Satisfaction
$(\mathbb{I}(Age_i \geq 60))\times Takeup_v$	1.946***	0.0400	-0.195	-1.346*	1.572*
	(0.489)	(0.477)	(0.235)	(0.601)	(0.651)
N	4768	4768	4768	4768	4768
Dependent Variable Mean	4.459	1.340	0.552	1.495	6.740
Dependent Variable SD	1.882	3.155	0.497	1.332	2.399

Notes: Estimates from equation 1 above, other parameters not shown in table. Standard errors in Parenthesis. * p<0.1, ** p<0.05, *** p<0.01

To better interpret these effects, I scale estimates by the first stage (β_{FS} =0.88) and the standard deviation.[10] For example, the cash transfer improves word recall by 1.16 standard deviations, improves depression by 1.14 standard deviations, and life satisfaction by 0.75 standard deviations. As hypothesized earlier, there are only small and insignificant changes for other domains of cognition. Further work will continue to examine other measures of mental health in the HAALSI survey, such as subjective social rank, self rated health, and a subjective wellbeing index.

To illustrate the magnitude of these effects, I benchmark them against educational gradients in cognition. For example, relative to those with no education, individuals with primary education

[8] Since there are only 27 villages, I also estimate a Wild bootstrap exact p-value (Cameron, Gelbach, & Miller. (2008). Bootstrapped Based Improvements for Inference with Clustered Standard Errors. *Review of Economics and Statistics*). Takeup is estimated directly from the HAALSI survey, as the percent of those 60 and over who receive the OAG pension. While this may introduce measurement error, survey documentation notes that the the samples are close to a 100% census for each village's population 60 and over.

[9] See: McEwen and Gianaros. (2010)."Central Role of the Brain in Stress Adaptation: Links to Socioeconomic Status, Health and Disease." *Proceedings of the New York Academy of Sciences*.

[10] To estimate the first stage, I regress a dummy variable for takeup of the OAG on the estimating equation above. The first stage parameter correspondent to the $\beta_2$coefficient in the model.

have word recall scores 0.7 SD higher, and those with secondary education have scores 1.3 SDs higher. These results suggest then that expanding this pension program would have sizeable effects.

I do not find evidence that cognitive health was improved through other channels besides depression, stress, and subjective wellbeing. For example, I do not observe statistically significant changes in chronic diseases risk factors for cognitive health, like BMI or hypertension. Nor do I observe significant improvements in healthcare utilization, treatment for conditions like high blood pressure or diabetes, or improvements in food security.

Heterogeneity by Age and Gender

One the most important risk factors for poor cognitive functioning is age. Thus, the effects of pension income may be easier to observe among older respondents where there is more variation in cognitive functioning and the potential for larger impacts of the transfer.

I will also examine heterogeneity in the results by gender and age for the conference. Women's and men's (cognitive) health may be differentially responsive to income from the cash transfers for a variety of reasons related to differential stress exposures, prevalence of depression and cardiovascular diseases, and susceptibility to cognitive aging (men's cognition begins to declines earlier than women's, for example), as well as disparities in protective factors like education. It will be important to not only understand whether the policy levers like cash transfers impact cognitive health, but whether they can also address – or exacerbate – disparities across social strata.

Robustness Checks and Alternative Estimation Strategies

While I cannot randomize the pension to individuals or to different villages, I can "ex post" randomize the village-level take-up rates of the OAG that I observe in the data. To do this, I randomly draw a take-up rate observed in the data and assign it to another village and re-estimate the models, which yields a "placebo" treatment effect. I repeat this 999 times and calculate an exact p-value, which will measure the chance that the treatment effect I estimate is due to random variation in the data.

I also consider a regression discontinuity as an alternative estimation strategy. Using age as the running variable, I test for discontinuities at 60. However, the external validity of this design is limited since I cannot abstract to ages beyond the cutoff, where variation in cognitive health is larger and where the cash transfer may have the greatest impact.

Discussion and Conclusion

The results of this paper will contribute to several areas of knowledge. Foremost, it helps inform what type of policy interventions may improve cognitive health among aging adults in low and middle income countries. Specifically, the role of cash transfers in improving subjective wellbeing, stress, and depression, which contribute to better cognitive health. Second, it contributes concrete evidence about the effects of non-contributory pension policies and (unconditional) cash transfers to adults more generally, an increasingly common policy response in many LMICs undergoing demographic transitions. The remainder of the discussion will focus on external validity of results and how the estimates compare to those from other studies.