Shortened Lives, Cognitive Functioning & Social Preferences

Experimental Evidence from a Study of Huntington's Disease

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Abstract

Huntington's Disease (HD) is a genetic disease associated with significant reductions in life expectancy and quality of life for patients, with serious implications for their carers/relatives too. Once manifested, it leads to rapidly declining cognitive functioning, excessive risk-taking and poor financial management. This research applies behavioural experimental methods in exploring the relationships between impairments associated with Huntington's Disease and social preferences – within a panel of HD and pre-manifest HD patients playing Dictator, Ultimatum, Trust and Public Goods Games. Preliminary findings suggest that HD symptoms correlate with generous offers in most of these games. One interpretation is that, assuming social preferences are hard-wired and innate, then impaired cognitive functioning increases the likelihood of generosity because automatic, instinctive System 1 thinking dominates the cognitive, deliberative System 2 thinking which is usually the focus in economic analysis and game theory.

Introduction

Previous economic analyses of HD have drawn on insights from Brunnermeier and Parker (2005) around expectations and optimism bias, linking these phenomena to impacts of shortened life expectancy on limited human capital accumulation, especially in terms of the uptake of education and training (Oster et al. 2013a, 2013b). In addition, economic analyses have explored genetic adverse selection in health insurance markets and genetic discrimination – in the context of HD as well as a wider range of neurodegenerative disorders (Oster et al. 2010, Tabbarrok 1994). These analyses have generally been based around standard economic models embedding strict assumptions about rationality, including stable time and risk preferences. In the study described here, we are aiming to extend the analysis by embedding insights from behavioural economics, social economics and neuroeconomics (e.g. as explored by Baddeley 2010), as well as connecting with insights from medical and clinical research into HD (e.g. Barker and Mason 2014).

Methods and Materials

The methods used include a range of behavioural experimental games – the Dictator Game (DG), Ultimatum Game (UG), Trust Game (TG) and Public Good Games (PGG), with each player given £100 to distribute between themselves and others. The PGG was adapted to three cases of charitable donations, including an international charity (Oxfam), and the Huntington's Disease Association (HDA), both national and local. Three levels of charity were included to capture whether offers were affected by how closely participants identified with specific charitable causes. (Experimental instructions are available upon request.) The participants also completed a set of standardised tests – including the Unified Huntington's Disease Rating Scale (UHDRS) and the Reading the Mind in the Eyes Empathy Test (RMET). Data from the wider range of tests will be analysed at a latter stage.

The results described here come from games played by a panel of 8 HD and 6 pre-manifest HD patients during their clinical visits to the John van Geest Centre for Brain Repair, Addenbrookes Hospital/University of Cambridge – over the period July to October 2016. Participants were paid a show-up fee but, following protocols adopted in previous similar studies of vulnerable patients – including brain lesion studies, the money used was dummy money distributed in the form of approved Bank of England facsimile £5 notes. Using dummy versus real money was considered carefully and in consultation with the Cambridgeshire Research Ethics Committee, reflecting concerns that allowing vulnerable patients to play with real money was potentially unethical. This study has ethics approval from the Cambridgeshire Research Ethics Committee.

Data were analysed econometrically using STATA 14.0 Tobit truncated estimation methods. Estimations were bound within the range of feasible offers – with a lower bound of 0 and, with one exception, an upper bound of 100. Reflecting standard protocols for TGs – amounts offered in Stage 1 were tripled before being given to the Stage 2 player – so the upper bound for Stage 2 of the TGs was the maximum offer possible of 300. The results here are preliminary and subject to change because the current sample size is small and prone to bias, though micronumerosity does not seem to have compromised the power of hypothesis tests too much. Final results will cover a larger sample and a more extensive analysis of all data collected.

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Results

The results are summarised in Table 1. There were positive and statistically significant (at 10% or less) associations between the size of offers and UHDRS and RMET scores, except for reciprocal offers in the TG and offers in the Oxfam PGG.

Table 1. Tobit Estimations – Size of offer, n=14

	Explanatory variable	Coefficient	t test H_0:β=0 *p* value	Significance
DG	UHDRS	1.63	0.003	***
	RMET	0.42	0.000	***
UG - offer	UHDRS	2.95	0.017	**
	RMET	1.03	0.000	***
TG – Stage 1	UHDRS	5.14	0.060	*
	RMET	1.73	0.001	***
TG – Stage 2	UHDRS	1.78	0.185	n/s
	RMET	0.09	0.810	n/s
PGG – Oxfam	UHDRS	0.40	0.747	n/s
	RMET	0.17	0.542	n/s
PGG – HDA national	UHDRS	3.47	0.023	**
	RMET	1.01	0.001	***
PGG – HDA local	UHDRS	3.64	0.019	**
	RMET	1.07	0.000	***
	*** significant at 1%	** significant at 5%	* significant at 10%	n/s not significant at 10%

Discussion

With the exception of offers in Stage 2 of the TG and the Oxfam PGG – social preferences, manifested as more generous offers in behavioural games, are positively and significantly associated with empathy – as measured by the RMET, and HD symptoms – as measured by the UHDRS. The link with empathy is not surprising. The possibility that the link between generosity and UHDRS is spurious, reflecting multicollinearity between RMET and UHDRS, was thought less likely because the correlation between RMET and UHDRS is negative. The analysis is ongoing and if these findings are verified across a larger sample, one possible interpretation is that our generous instincts are hard-wired by evolution and are more likely to dominate if cognitive functioning is impaired. This interpretation is consistent with Rand and Nowak's (2013) analysis of human co-operation as an evolutionary hard-wired response associated with System 1 intuitive, automatic decision-making, whilst standard economic maximising behaviour is associated with System 2 cognitive processing. These findings also link with neuroeconomic studies of the interplay of dual systems thinking in ultimatum games (e.g. Sanfey et al. 2003) and inter-temporal decision-making (e.g. McClure et al. 2004).

Conclusions

Our analysis suggests that offers made in behavioural games are positively and (mostly) significantly correlated with HD symptoms – as measured by the UHDRS. A possible explanation is that generosity is associated with instinctive, automatic decision-making processes, more likely to dominate if cognitive functioning is impaired. Our analysis is incomplete and we are enlarging the sample size as part of the ongoing study. We will also extend the analysis to explore links between HD and other behavioural data – including measures of time/risk preferences and social learning. A key goal of this study is to use the findings to improve the clinical care of HD patients and support for relatives and carers – including in terms of better strategies for financial management/planning. With improved understanding of vulnerabilities experienced by HD sufferers, we may be better able to alleviate their suffering and pressures experienced by carers and relatives.

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