

Factors associated with costs incurred by schizophrenia patients with cognitive deficits

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INTRODUCTION

Cognitive deficits are highlighted by patients with schizophrenia as affecting their functioning and quality of life. There is also a wealth of evidence pointing to the influence of these deficits on current and future social functioning (Wykes & Dunn, 1992) and in treatment outcome (Mueser *et al.*, 1991). Recently it has been suggested that these deficits are more directly related to functioning outcomes than symptoms, which accounts for the paucity of predictive relationships in previous studies linking symptoms and future outcome (Green, 1998). People with schizophrenia make heavy use of both inpatient and community based services. For example, a study of an epidemiologically representative sample of people with psychoses examined service use and costs in two defined geographical sectors in south London – one which had implemented a standard community care approach and another which had adopted a more intensive care approach (McCrone *et al.*, 1998). Rates of ever having been admitted to hospital for psychiatric problems were 93% and 96% in each group respectively, and 6% and 21% had had an inpatient stay of greater than one year. Following the implementation of community mental health teams, average 6-month costs per patient for all measured services were £5923 (1995/96 prices) in the standard sector and £6568 in the intensive sector, with supported accommodation contributing to the bulk of these costs. Another study examining the heaviest 10% of psychiatric inpatient service users in a north London borough (of which two-thirds were people with schizophrenia, schizotypal and delusional disorders) found annual health care costs amounted to an average of £8710 (1995/96 prices) (Lucas *et al.*, 2001).

Therefore, if cognitive deficits in people with schizophrenia could be reduced there could be obvious potential benefits to both patients and psychiatric services. Not only would there be increases in quality of life, but there would also be less dependence on psychiatric care and the possibility of fewer admissions to hospital. The overall social and financial costs of the disorder may therefore be decreased.

This paper reports societal costs incurred by people with schizophrenia with cognitive difficulties. It also examines the relationship between health/social care costs and cognition so as to establish whether there is potential for effective interventions for cognitive deficits to also bring about reductions in costs.

Previous studies of cognition in schizophrenia patients have commonly reported cognition as a single summary measure, rather than differentiating between the constituent factors that contribute to overall levels of cognition. Therefore, a particular feature of the analyses was to additionally explore, through structural equation models, whether any of three pre-defined elements of cognition were associated with health/social care costs.

METHODS

Subjects and setting

Subjects were recruited to a randomised controlled trial of cognitive remediation therapy (CRT) versus standard care. All reported data are from baseline assessments carried out prior to randomisation. People were recruited into the study if they fulfilled the following criteria: in contact with local psychiatric services for at least two years; diagnosis of schizophrenia based on DSM-IV; evidence of some cognitive difficulties (poor memory or cognitive flexibility); and evidence of social functioning problems (scored at least one problem on the Social Behaviour Schedule (SBS; Wykes & Sturt, 1986).

Data collection

Research psychologists collected individual-level data on a range of outcome measures, through face-to-face interviews. Data for the economic evaluation were collected using the Client Socio-Demographic and Service Receipt Inventory (CSSRI) (Chisholm *et al.*, 2000). The CSSRI covered questions about subjects' current demographic profile, living situation, employment status and income, plus data concerning lost days from work and use of health, social care and criminal justice system resources for a retrospective six-month period. Where data could not be obtained from subjects, supplementary information was obtained from health care records.

Costs

Costs were calculated from the resource utilisation measures for each subject. Unit costs were attached to each service or element of support in turn, using best available estimates. All health and social care service costs were based on national estimates in Netten *et al.* (2001) and were adjusted to reflect higher costs in London. Medication costs were based on prices reported by the Joint Formulary Committee (2002). (2000 and 1989 editions were also consulted to obtain information on some discontinued medications). Costs of specialist education services were estimated from statistics published by the Chartered Institute of Public Finance and Accountancy (2000). Social security benefit rates were obtained from the UK Department for Work and Pensions (2003). Lost productivity

costs for time taken off work by those in employment were estimated using national average earning rates (National Statistics, 2001). Police contact costs were estimated from figures reported by Finn *et al.* (2000). All unit costs were standardised to 2000/01 prices and combined with resource volumes to obtain a cost per subject over the entire six-month assessment period. All costs are reported as mean values over 6 months with standard deviations.

Cognition measures

The main outcome measure for the trial was improvement in cognition. This was measured within three domains: cognitive flexibility, memory and planning, using the following instruments:

Cognitive flexibility

- Trails
- Response Processing Task
- Controlled Oral Word Fluency Test
- The Continuous Performance Test
- Stroop Neuropsychological Screening Test
- Wisconsin Card Sort Test
- Hayling Sentence Completion task

Memory

- The Rivermead Behavioural Memory Test
- The Wechsler Logical Memory Test I and II
- Digit span from the WAIS-III
- The Doors Test
- Letter-Number Sequencing from the WAIS-III
- The Benton Visual Retention Test

Planning

- Six Elements from Behavioural Assessment for Dysexecutive Syndrome
- Zoo Map Test

Analyses

In order to examine the relationship between cognition and health and social care costs, a series of structural (CHANGE by BSE) equation models (SEM) (see *Dunn et al.*, 1993) were fitted to the observed correlation values of the cognition variables. The following elements of the Social Behaviour Schedule (Wykes & Sturt, 1986) were also included in the models to control for the effects of social behaviour: thought disturbance, anti-social behaviour, depressed behaviour and social withdrawal. A range of other symptomology and demographic factors were considered for inclusion in the models (Positive and Negative Syndrome Scale, age, gender, marital status and ethnicity) but were

eventually excluded on the basis that they were unlikely to be independently related to cognition or costs and any such relationships would be represented through cognition and SBS factors.

In total, there were 15 cognition and social behaviour observed variables of interest, as specified below:

MTRAILS	Trails: time taken for part B
BADSTRS	BADS Zoo-map: total raw score
BADKYRS	BADS Key-search: total raw score
LETNUMT	Letter-number sequencing: total raw score
WORDCO	Verbal fluency (FAS): total number of correct responses
NSCORE	Six elements: total score
DIGRAW	WAIS-III digit span raw score
MINCO4M	Response inhibition
CW12	Stroop: colour-word task
MSEVTOT	WCST: number of perseverative errors
MHAYCON	Hayling: converted error score
THODIS	Social Behaviour Schedule: thought disturbance factor
ANTISOC	Social Behaviour Schedule: anti-social behaviour factor
DEPRESS	Social Behaviour Schedule: depressed behaviour
SOCWITH	Social Behaviour Schedule: social withdrawal

Where relevant, these variables were transformed (multiplied by -1) so that higher scores in all variables indicated better cognition/social behaviour. Due to a lack of evidence concerning whether any particular aspects of cognition are associated with service use, the relationship between cognition and costs was explored using two approaches. Firstly, with all 11 cognition variables represented through a single latent variable, in keeping with previous studies of cognition that have used a single summary measure for cognition. Secondly, with cognition variables categorised into three latent variables, each representing one of the three domains of cognition set out earlier: cognitive flexibility, memory and planning.

Total health and social care costs consisted of four different cost categories, represented by the following four variables:

£ACCOM	Specialised accommodation costs
£OUTPAT	Hospital outpatient costs
£COMPRIM	Community and primary health/social services
£DRUG	Medication costs

Thus the dependent variable for total health and social care costs was also analysed using two approaches. Firstly as a single observed variable (£HEALTH) representing the sum of all four cost categories and, secondly, as a latent variable indicated by the four separate cost variables (CHANGE by BSE). The four SBS variables were included as observed variables.

Four different path diagrams were developed to reflect the different configurations of the variables of interest:

- Latent dependent (cost) variable with 3 latent cognition variables (Figure 1a)
- Observed dependent (cost) variable with 3 latent cognition variables (Figure 1b)
- Latent dependent (cost) variable with 1 latent cognition variable (Figure 1c)
- Observed dependent (cost) variable with 1 latent cognition variable (Figure 1d)

The respective path diagrams for the hypothesised relationships between factors in each of the four models specified above are shown in Figure 1. Parameters in a model are estimated so that the covariance (or correlation) matrix of the observed variables, as predicted by the model, is as close as possible to the observed covariance matrix of these variables (see Dunn *et al.*, (1993) for details of CHANGE by BSE). Measures of fit are used to assess how suitable a model is for the observations. EQS software was used to fit the models (again see Dunn *et al.*, 1993).

Analyses were based on complete cases only. Thirteen of the 85 cases had some missing data in cognition, social behaviour or cost variables, reducing the available sample to 72. In order to increase the number of analysable cases, we imputed missing values for cognition and social behaviour variables for 7 cases, increasing the final sample to 79. Imputation was carried out using the regression method imputation function in SPSS, based on all cognition and social behaviour variables. The remaining 6 cases had missing cost data and were excluded from the analyses, as there was no reasonable basis on which to impute missing values.

Clearly the number of subjects is too small for some of the asymptotic results of structural equation modelling to be strictly valid and so results have to be interpreted with some caution.

RESULTS

Characteristics

Eighty-five subjects were included in the study. Sixty-two (73%) were male and the average age was 36 years. Eighty (94%) were single (including divorced, separated and widowed) and the remaining 5 (6%) were married. Thirty-eight (45%) were of white ethnicity, with the remaining being black Caribbean (16%), black African (5%), black other (8%), Indian (11%) and other (16%).

Education, employment and income

Subjects had received an average of 11.5 years of schooling and only 4 had not completed secondary education (Table 1). Only 8 were in paid, voluntary or sheltered employment. Of the 3 subjects in paid employment, one had taken time off work due to illness in the previous 6 months, totalling 40 days off work and an estimated £2807 in lost productivity costs. Of the 71 subjects classified as unemployed, all but one had been unemployed for the entire 6-month assessment period. Eighty-one (96%) were in receipt of state social security benefits and 91% reported benefits to be their main source of income.

Resource use and costs

Forty-five (54%) subjects described their usual place of living as a hospital or other specialised accommodation facility (Table 2). Of these, the majority were either in a hospital psychiatric rehabilitation ward or a 24-hour staffed facility. Of the 39 subjects living in domestic housing, 24 were in housing rented from a local authority or a housing association.

Only one non-psychiatric hospital stay was reported (Table 3). Use of hospital outpatient services was modest except for 3 subjects who had an average of 55 day hospital attendances each over 6 months. Day care centres were the most commonly used community-based day service, used by over a third of the group, with an average of 50 attendances each over 6 months. Community mental health centres were used by a quarter of subjects, at an average rate of 16 attendances each. The most commonly used primary and community care services were psychiatrist (74%), community psychiatric nurse (65%) and social worker (32%). Three subjects who had assistance from a home help or a care worker had on average 70 contacts each. The most widely used medication was clozapine, used by 29 (36%) subjects. Only one subject reported receiving no medications over the 6-month period. Contacts with criminal justice system services were rare - one subject had spent one night in a police cell.

Average costs associated with these resources are given in Table 4. After adding the costs of lost productivity due to time off work and the value of social security benefits claimed, average total societal costs were £15114. No subjects had zero costs. Unsurprisingly, specialised accommodation costs dominated all other costs (62% of total societal costs and 73% of health and social care costs). The value of social security benefits received was equivalent to almost two-thirds the amount of non-accommodation health and social care costs.

Relationships between costs and cognition

Figures 1a and 1b: No significant relationships were found between any of the three latent cognition variables and costs (Figures 1a and 1b).

Figure 1d: The parameter estimates for the model represented by Figure 1d are shown in Table 5. The Chi-square test of fit showed that the model appeared to fit the observed data very well ($\chi^2 = 124.9$; $df = 102$; $p = 0.06$) although it has to be remembered that given the small number of subjects the power of the test is low. The essential feature of this model was the regression of costs on a

single latent cognition variable that represented all 15 observed variables. The estimated regression coefficient of cognition on cost in this equation was -0.39 (95% confidence interval: -0.62, -0.16), which indicates that subjects with higher (better) cognition scores tended to have lower costs.

Figure 1c: Treating the dependent cost variable as a latent variable, with loadings from four cost categories (Figure 1c), did not improve the goodness of fit reported above for Figure 1d.

None of the four social behaviour variables were associated with costs and it is possible that a model excluding these would be adequate to describe the data.

[A far more detailed account of these models will be incorporated into future drafts of the paper.]

DISCUSSION

These data show that people with schizophrenia are cared for in a wide variety of settings across primary, secondary and community care, and that the costs associated with these inputs are quite considerable. Cognitive deficits associated with schizophrenia have previously been shown to be predictive of future care and to affect psycho-social treatment outcome. Those patients with the severest deficits are more likely to be living in settings with high levels of psychiatric support, and consequently to be consuming a large amount of health and social care resources. The structural equation model presented in this paper supports this by indicating that cognition, as a single summary measure, was negatively associated with costs. The on-going trial, from which these baseline data came, aims to determine whether CRT reduces cognitive deficit levels. Prior understanding of the links between cognitive deficits and costs demonstrates the potential impact on the costs of this patient group. However, only cognition as a whole was associated with cost, rather than any of the three individual elements of cognition (cognitive flexibility, memory and planning). [Discussion of the possible clinical explanations for this will be added to the paper later]. Thus CRT may need to improve cognition overall in order to bring about reductions in health and social care costs. In fact, a previous exploratory study showed that CRT & control groups had similar reductions in care costs over time, but CRT patients had significantly higher day care costs. Greater use of day care possibly confers further advantages, e.g. better social functioning and quality of life. As 73% of average total health/social care costs consisted of specialised accommodation, improvements in cognition would need to be sufficiently large to affect length of stay in specialised accommodation.

However, these conclusions are tentative as the study has limitations. Firstly, the study sample size was small, limiting the power of the SEM analyses. On the other hand, it should be noted that this is one of the largest reported samples of these types of patients. The SEM analyses were further limited by including only complete cases.

A further limitation necessarily arose from the nature of the study – the study recruited a relatively narrow sub-group of people with schizophrenia i.e. those with particularly severe cognitive difficulties.

Therefore, the range of values in the cognition variables may not have been sufficiently variable to demonstrate any strong relationships. Similarly, the variance in the values for the social behaviour variables may also have been too small to detect relationships between them and costs.

This work is still in progress and we aim to explore two further avenues for the analyses:

- To review the SEM models to ensure that the paths between variables are sensible from both clinical and economic perspectives and that all relevant hypothesised links between factors are represented.
- To consider the possibility that the *cost* of health and social care may not be the most appropriate dependent variable for this patient group. Although analysis of average costs is important from a funding perspective, it may conceal important patient-centred effects such as altered care patterns. Interventions in this patient group are unlikely to impact on the amount of use of a particular service if an individual continues to use that service, but may impact on whether or not the individual continues to use a particular service, or takes up use of a previously unused service. Therefore, an alternative approach would be to explore the *likelihood* of individuals to use particular services. Two of the SEMs incorporated elements of this concept by representing total costs as a latent variable consisting of four cost categories, but the issue needs further exploration.

Acknowledgements

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Table 1: Educational background, current employment and current income

Schooling		
Number of years (mean, range)	11.5	(2-17)
	n	(%)
Highest completed level of education		
Primary or less	4	(4.9)
Secondary	60	(73.2)
Tertiary/further	18	(22.0)
Employment status		
Paid or self employment	3	(3.6)
Voluntary employment	4	(4.8)
Sheltered employment	1	(1.2)
Unemployed	71	(84.5)
Student	3	(3.6)
Housewife/husband	1	(1.2)
Other	1	(1.2)
Receipt of social security benefits		
Receive any benefits	81	(96.4)
Income support	68	(81.0)
Jobseeker's allowance	2	(2.4)
Disability living allowance	45	(53.6)
Statutory sick pay	1	(1.2)
Housing benefit	32	(38.1)
State pension	3	(3.6)
Child benefit	3	(3.6)
Other	4	(4.8)
Main source of income		
Salary/wage	3	(3.6)
State benefits	76	(90.5)
Pension	2	(2.4)
Family support	3	(3.6)
Total personal gross weekly income from all sources		
Under £149	75	(89.3)
£150 - 204	8	(9.5)
£205 - 279	0	
£280 - 392	1	(1.2)
More than £393	0	

Table 2: Current usual living situation

	n	(%)
Usual living situation		
Alone (+/- children)	17	(20.2)
With spouse (+/- children)	4	(4.8)
With parents	17	(20.2)
With others	46	(54.8)
Type of accommodation		
Owner occupied	10	(11.9)
Privately rented	5	(6.0)
Rented from local authority/housing association	24	(28.6)
Overnight facility, staffed 24 hours	18	(21.4)
Overnight facility, staffed less than 24 hours	3	(3.6)
Overnight facility, unstaffed	2	(2.4)
Acute psychiatric ward	1	(1.2)
Psychiatric rehabilitation ward	18	(21.4)
Long-stay psychiatric ward	3	(3.6)
Lived elsewhere in past 6 months	23	(27.4)

Table 3: Use of health and social care services in previous 6 months

Inpatient services¹	Number (%) who used service	Mean number of admissions²	Mean number of days²
Emergency/crisis centre	0		
General medical ward	1 (1.2)	1	4
Other	0		
Outpatient services	Number (%) who used service	Mean number of attendances²	
Psychiatric outpatient visit	16 (19.3)	4.5	
Other hospital outpatient visit	6 (7.2)	1.3	
Day hospital	3 (3.6)	55	
Other	2 (2.4)	9	
Community-based day services	Number (%) who used service	Mean number of attendances²	
Community mental health centre	21 (25.3)	15.6	
Day care centre	30 (36.1)	50.4	
Group therapy	7 (8.4)	14.3	
Sheltered workshop	2 (2.4)	84	
Specialist education	7 (8.4)	22.6	
Other	1 (1.2)	24	
Primary & community care services	Number (%) who used service	Mean number of attendances²	
Psychiatrist	61 (74.4)	5.6	
Psychologist	13 (15.9)	7.3	
General practitioner	18 (22.0)	3.9	
District nurse	0		
Community psychiatric nurse / case manager	53 (64.6)	14.2	
Social worker	26 (31.7)	7.3	
Occupational therapist	15 (18.3)	28.4	
Home help / care worker	3 (3.7)	70.3	
Other	8 (9.8)	27.8	

1. In order to avoid double-counting, stays in the following types of wards are not reported here due to inseparability from specialised accommodation reported as 'usual living situation': acute psychiatric ward, psychiatric rehabilitation ward & long-stay ward.

2. Mean calculation based on users only.

Table 4: Societal costs over 6 months (£, 2000/01 prices)

	Mean (£)	(SD)
Specialised accommodation¹		
Total	9418.88	(10436)
Inpatient services		
Emergency / crisis centre	0	
General medical ward	11.52	(106)
Other	0	
Total	11.52	(106)
Outpatient services		
Psychiatric	111.04	(304)
Other outpatient specialties	7.13	(30)
Day hospital	135.18	(709)
Other	16.05	(108)
Total	269.40	(763)
Community-based day services		
Community mental health centre	276.68	(756)
Day care centre	595.15	(1363)
Group therapy	13.72	(62)
Sheltered workshop	35.73	(249)
Specialist education	39.12	(156)
Other	2.33	(21)
Total	962.72	(1552)
Primary & community care services		
Psychiatrist	329.54	(704)
Psychologist	76.75	(275)
General practitioner	25.90	(126)
District nurse	0	
Community psychiatric nurse / case manager	337.24	(841)
Social worker	142.13	(406)
Occupational therapist	244.24	(1061)
Home help / care worker	22.80	(146)
Other	135.23	(853)
Total	1313.82	(2058)
Medications		
Total	890.65	(655)
Social security benefits		
Total	2243.43	(1228)
Criminal justice system services		
Total	0.65	(6)
Total	15113.92	(10929)

1. Includes stays in staffed and unstaffed overnight facilities, acute psychiatric wards, psychiatric rehabilitation wards and long-stay psychiatric wards.

Table 5: Parameter estimates for model represented in Figure 1d

Goodness of fit: $X^2 = 124.9$; $df = 102$; $p = 0.06$

Observed cognition variables	Estimated loading of each variable on COGNITION	SE	Z-Statistic
MTRAILS	0.597	0.108	5.529
BADSTRS	0.621	0.107	5.812
BADKYRS	0.642	0.113	4.094
LETNUMT	0.790	0.098	8.043
WORDCO	0.664	0.105	6.335
NSCORE	0.717	0.102	7.018
DIGRAW	0.552	0.110	5.029
MINCO4M	0.688	0.104	6.636
CW12	0.725	0.102	7.124
MSEVTOT	0.255	0.118	2.170
MHAYCON	0.596	0.108	5.526
Estimated regression coefficients of cost on other variables			
THODIS	-0.091	0.124	-0.733
ANTISOC	0.181	0.124	1.469
DEPRESS	0.074	0.100	0.734
SOCWITH	0.150	0.107	1.399
COGNITION (latent variable)	-0.393	0.118	-3.341

Figure 1: Path diagrams

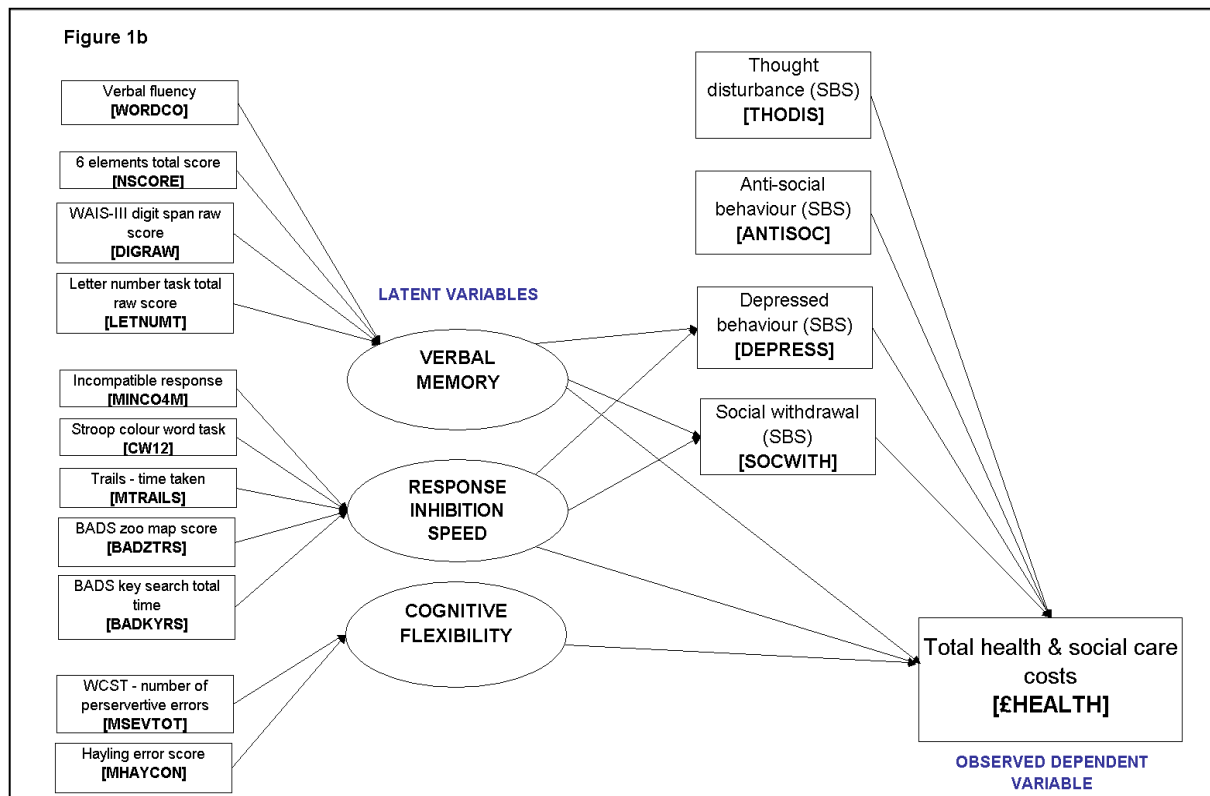
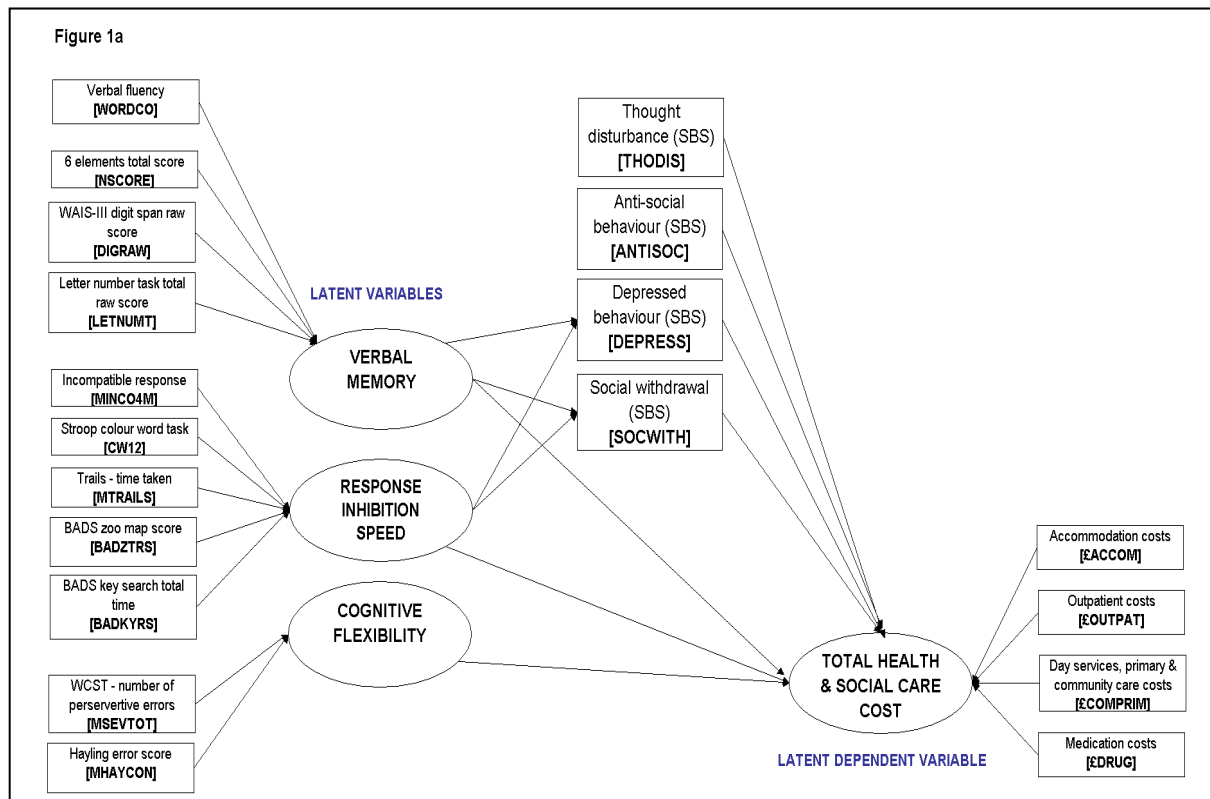


Figure 1 cont.

