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Do cognitive complaints either predict future cognitive decline or reflect past cognitive decline? A longitudinal study of an elderly community sample

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SYNOPSIS Data from a two-wave longitudinal study of an elderly community sample were used to assess whether cognitive complaints either predict subsequent cognitive decline or reflect past cognitive decline. Cognitive complaints and cognitive functioning were assessed on two occasions three and a half years apart. Cognitive complaints at Wave 1 were found not to predict future cognitive change on the Mini-Mental State Examination, an episodic memory test or a test of mental speed. Similarly, cognitive complaints at Wave 2 were unrelated to past cognitive changes on these tests after statistically controlling for the effects of anxiety and depression. Furthermore, cognitive complaints did not predict either mortality (after controlling for anxiety and depression) or future dementia. These results are evidence against the inclusion of cognitive complaints in diagnostic criteria for proposed disorders such as age-associated memory impairment, mild cognitive disorder and ageing-associated cognitive decline.

INTRODUCTION

In an earlier report, we presented data on cognitive complaints in an elderly community sample aged 70 or over (Jorm *et al*. 1994). While 62% of subjects believed that their memory was worse than earlier in life, only 6% felt that this interfered with their daily life. Similarly, 30% believed that they could not think and reason as well as earlier in life, but only 5% felt that this interfered with their life. Although cognitive complaints by subjects were relatively common, our study found that their validity was poor. Little relationship was found between the subjects' complaints and either informants' reports of decline or cognitive test results. Rather, complaints were correlated with symptoms of anxiety and depression and with the personality trait of neuroticism. Other cross-sectional studies of cognitive complaints have found associations with depression (Kahn *et al*. 1975; O'Hara *et al*. 1986; McGlone *et al*. 1990; O'Connor *et al*. 1990; Bolla *et al*. 1991) and neuroticism (Poitrenaud *et al*. 1989; Seidenberg *et al*. 1994), but little relationship to cognitive test performance (O'Hara *et al*. 1986; Sunderland *et al*. 1986; O'Connor *et al*. 1990).

Although cross-sectional studies of cognitive complaints have consistently found these to have poor validity, a more interesting question is whether they are related to longitudinal measures of cognitive performance. It is possible that people are aware of very subtle cognitive changes that are not detected by cross-sectional cognitive testing. Cognitive complaints could be related to past decline in cognitive performance or they might predict future decline. Consistent with the view that cognitive complaints have validity, subjective cognitive decline features in several classificatory systems intended for clinical or research use. The diagnostic criteria for age-associated memory impairment include complaints of memory loss (Crook *et al*. 1986), while the criteria for mild cognitive disorder (World Health Organization, 1993) and ageing-associated cognitive decline (Levy, 1994) require

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cognitive difficulties to be reported either by the individual or an informant. Similarly, in the Global Deterioration Scale, which is used to stage dementia, the second stage of 'very mild cognitive decline' is characterized by subjective complaints of memory deficit (Reisberg *et al.* 1982).

There appears to be only one longitudinal study on the association between complaints and past cognitive decline. Poitrenaud *et al.* (1989) found that complaints were unrelated to decline on cognitive tests over the previous 7 years. There are, however, several studies assessing whether complaints predict future decline. All but one of these failed to include a comparison group of non-complainers. O'Brien *et al.* (1992) reported a 3-year follow-up on 64 patients with memory complaints. They found that six of these patients became demented and the remaining patients showed relatively modest decline. Taylor *et al.* (1992) did a 4-year follow-up of 30 volunteer subjects with memory complaints. These subjects declined on an episodic memory task, but not on a test of mental speed. Flicker *et al.* (1993) did a 3-year follow-up of 59 elderly volunteers with memory complaints. They assessed these subjects on a battery of cognitive tests, with two of the tests showing significant decline, two significant improvement, and eight no significant change. Flicker *et al.* concluded that complainers are not at high risk for progressive deterioration. The only study to include a comparison group was recently reported by Tobiansky *et al.* (1995). They followed up an elderly community sample over 2 years and found that those with subjective memory impairment had four times the risk of developing dementia and twice the risk of depression. This is the only longitudinal study finding that complaints have some predictive validity.

In the present paper, we report a three and a half year follow-up of our earlier community study. Our longitudinal study of cognitive complainers is based on a representative community sample and, unlike many of the earlier studies, included non-complainers as well as complainers. Subjects were assessed for cognitive complaints and tested for cognitive performance at both waves of the study. The data allowed us to see; (*a*) whether cognitive complaints at Wave 2 reflect changes in cognitive performance between Waves 1 and 2; and (*b*) whether complaints at Wave 1 predict changes in performance between Waves 1 and 2. Since cognitive complaints are known to be correlated with anxiety and depression, these states may confound any relationship between complaints and cognitive performance. Accordingly, all associations were investigated while statistically controlling for anxiety and depression symptoms.

METHOD

The sample

The subjects were a sample of elderly persons, aged 70 or over and living in the community, from the Australian city of Canberra and the adjacent town of Queanbeyan. Subjects were selected from the electoral roll which is a compulsory register of eligible voters. The Wave 1 interviews of the subjects were undertaken in 1990–1991 and the Wave 2 interviews in 1994. The average time between interviews was 3·6 years. At Wave 1, there were 945 subjects (representing a 69% participation rate). Of these, 863 subjects had some data on cognitive complaints. Most of those who had missing data did so because they were too impaired to be interviewed and so only had an informant interview. Because dementia might influence a subject's ability to give valid self-report data, the 36 subjects with either DSM-III-R or ICD-10 dementia were excluded, as were the 106 with insufficient data to positively exclude dementia. (It is worth noting, however, that excluding these subjects made no substantive difference to the results reported below.) This left 721 non-demented subjects with data on cognitive complaints at Wave 1. Wave 2 cognitive complaints data were available for 507 of these subjects. Wave 2 data were not available on the remaining subjects seen at Wave 1 for the following reasons: 122 had died, 57 refused or could not be contacted and 35 had missing data.

Interviewers

The assessments were carried out by professional social survey interviewers who were specially trained for the task. The Wave 2 interviews were arranged so that subjects always had a different interviewer to Wave 1. The interviewers were blind to the Wave 1 results.

Assessment of complaints

Identical questions were asked to assess cognitive complaints at the first and second waves. The questions covered global complaints of memory and intellectual decline as well as specific aspects of everyday memory.

Global cognitive complaints

To assess global memory complaints, subjects were asked: 'Overall, do you feel you can remember things as well as you used to? That is, is you memory the same as it was earlier in life?' Subjects who responded 'No' or 'Depends' were then asked 'Does this interfere in any way with your day to day life?' Global intellectual complaints were assessed with the question 'Do you feel you can think and reason as clearly as earlier in life?' Subjects who responded 'No' or 'Don't know' were then asked: 'Does this interfere in any way with your day to day life?'.

Subjective Memory Decline Scale

Subjects were also asked a series of questions about change in specific areas of everyday memory. These questions were: 'Do you have more trouble remembering things that have happened recently?'; 'Are you worse at remembering where belongings are kept?'; 'Do you have trouble recalling conversations a few days later?'; 'Do you have more trouble remembering appointments and social arrangements?' Responses to these questions were rated on the following scale: 0, 'No, not much worse'; 1, 'A bit worse'; 2, 'Yes, a lot worse'. Item ratings were summed to give a score from 0 to 8. In the first wave, this subjective memory decline scale had a coefficient alpha of 0·71.

Assessment of cognitive decline

The following cognitive tests were given at both waves.

Mini-Mental State Examination (*MMSE*)

The MMSE is a brief global test of cognitive impairment which is widely used as a screening test for dementia (Folstein *et al*. 1975). It gives a score from 0 to 30, with a cut-off of 23/24 commonly used in screening.

National Adult Reading Test (*NART*)

The NART requires the subject to read aloud 50 irregularly spelled words (Nelson, 1982). it correlates highly with intelligence tests, but is relatively resistant to the effects of ageing and mild-moderate dementia. The NART is used here as a contrast to the other tests.

Symbol–Letter Modalities Test

This test is similar to the Digit–Symbol subtest of the Wechsler Intelligence Scale-Revised (Wechsler, 1981). Subjects have to say out loud the letters which go with geometric symbols (Christensen *et al*. 1994). The score is the number of letters correctly called out in 90 s.

Episodic Memory Test

This test consists of four brief episodic memory tasks: three-word recall, name and address recall, face recognition and figure reproduction (Jorm, 1992). The test gives a score from 0 to 16.

Assessment of dementia

At both waves, dementia was diagnosed using the Canberra Interview for the Elderly (CIE) (Social Psychiatry Research Unit, 1992; Mackinnon *et al*. 1993) according to both DSM-III-R and ICD-10 criteria. Subjects were regarded as demented if they fulfilled either set of criteria.

Assessment of neurotic symptoms

At both waves, subjects were given the anxiety and depression scales of Goldberg *et al*. (1988). The validity of these scales in the present sample has been previously reported by Mackinnon *et al*. (1994).

Statistical analysis

Hierarchical multiple regression analysis was used to assess whether cognitive complaints were related to change in cognitive performance. Variables associated with change in cognitive test performance between waves were evaluated using a conditional regression approach, in which cognitive test score at Wave 2 was the dependent variable and the score at Wave 1 was a predictor variable. To see if complaints reflect past cognitive change when anxiety and depression are controlled, Wave 1 test score was entered on the first step, Wave 2 anxiety and depression symptoms on the second step and Wave 2 complaints on the third step. To see if

complaints predict future cognitive change when anxiety and depression are controlled, Wave 1 test performance was entered as a predictor on the first step, Wave 1 anxiety and depression symptoms on the second step and Wave 1 complaints on the third step. The R^2 change for the regression model was used as an index of the association of each predictor variable with the Wave 2 test score, controlling for the effects of the predictor variables added earlier. The R^2 change gives the additional proportion of variance accounted for by the predictor added at that step in the regression analysis.

In these regression analyses, cognitive complaints were entered in two ways. In one set of analyses, the four global cognitive complaint questions were entered entered as a set of predictors on the third step. In the other set of analyses, the Subjective Memory Decline scale was entered as a predictor on the third step. By carrying out both types of analysis it was possible to find out if global and specific complaints have the same predictive power.

To assess whether complaints at Wave 1 predict either dementia at Wave 2 or mortality between waves, logistic regression analyses were carried out. Logistic regression was used because the dependent variables (dementia and mortality) are dichotomous rather than continuous. In these analyses, anxiety and depression were entered as predictors on the first step and complaints on the second step. The aim of the analyses was to see if complaints predict dementia or mortality when the level of anxiety and depression is held constant.

Supplementary regression analyses were carried out entering age as a predictor in all the above models, but this variable made no substantive difference, so the results are not reported here.

A significance level of $P < 0{\cdot}05$ was used for all effects.

RESULTS

Although Wave 1 cognitive complaints data were available for 721 subjects and Wave 2 data for 507, the numbers involved in the analyses reported here vary because of missing data on some variables. The numbers for the main analyses are reported in footnotes to the tables described below.

Future change on cognitive tests

Regression analyses were carried out predicting future cognitive change from global complaints at Wave 1. The results were very similar whether or not anxiety and depression were entered as predictors. Tables 1 and 2 show the results of the full hierarchical analysis in which anxiety and depression were entered before cognitive complaints. It can be seen that global complaints added very little to the R^2 for the regression models for any of the cognitive tests. In other words, global complaints do not predict change on cognitive tests when levels of anxiety and depression are held constant. Table 2 shows very similar results for the regression analyses with the Subjective Memory Decline Scale as the predictor.

Past change on cognitive tests

Similar regression analyses were carried out predicting past cognitive change (from Wave 1 to Wave 2) from complaints at Wave 2. When complaints were entered in the regressions without anxiety and depression, some relationships were found. Global complaints had a small but significant relationship with past change on the Symbol–Letter Modalities Test (R^2 change $= 0{\cdot}010$, $P = 0{\cdot}045$) and the Episodic Memory Test (R^2 change $= 0{\cdot}016$, $P = 0{\cdot}047$). Similarly, Subjective Memory Decline had a small but significant relationship with past change on the MMSE (R^2 change $= 0{\cdot}006$, $P = 0{\cdot}036$) and the Episodic Memory Test (R^2 change $= 0{\cdot}009$, $P = 0{\cdot}019$). However, in the full regression models, where Wave 2 anxiety and depression symptoms were entered before complaints, a different result emerged. These results are shown in Tables 3 and 4. Anxiety and depression were a predictor of past change on the MMSE, the Episodic Memory Test and the Symbol–Letter Modalities Test. However, cognitive complaints added nothing further to the R^2 for the models, implying that they are not associated with past change on cognitive tests when levels of anxiety and depression are held constant.

Dementia

Dementia was found at Wave 2 in 3·7% ($N = 28$) of the subjects. Because subjects demented at Wave 1 were excluded from this paper, these were all new cases. Logistic regression analyses

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Table 1. *Association of global cognitive complaints with future change on cognitive tests: hierarchical regression predicting cognitive performance at Wave 2 from global complaints at Wave 1, controlling for performance at Wave 1 and anxiety and depression*

Predictor variables	*R*	R^2	R^2 change	*P*-value for change
Dependent variable: MMSE at Wave 2				
1 MMSE at Wave 1	0·495	0·245	0·245	0·000
2 Anxiety and depression at Wave 1	0·505	0·255	0·009	0·042
3 Global complaints at Wave 1	0·506	0·256	0·001	0·975
Dependent variable: Episodic Memory Test at Wave 2				
1 Episodic Memory at Wave 1	0·475	0·225	0·225	0·000
2 Anxiety and depression at Wave 1	0·480	0·230	0·005	0·245
3 Global complaints at Wave 1	0·486	0·236	0·006	0·432
Dependent variable: Symbol–Letter Modalities Test at Wave 2				
1 Symbol–Letter Modalities at Wave 1	0·701	0·492	0·492	0·000
2 Anxiety and depression at Wave 1	0·705	0·496	0·005	0·108
3 Global complaints at Wave 1	0·705	0·497	0·001	0·948
Dependent variable: NART at Wave 2				
1 NART at Wave 1	0·838	0·701	0·701	0·000
2 Anxiety and depression at Wave 1	0·838	0·703	0·001	0·373
3 Global complaints at Wave 1	0·842	0·708	0·006	0·074

Note: *N* varied for each analysis from 507 (MMSE) to 461 (NART).

Table 2. *Association of the Subjective Memory Decline Scale with future change on cognitive tests: hierarchical regression predicting cognitive performance at Wave 2 from the Subjective Memory Decline Scale at Wave 1, controlling for performance at Wave 1 and anxiety and depression*

Predictor variables	*R*	R^2	R^2 change	*P*-value for change
Dependent variable: MMSE at Wave 2				
1 MMSE at Wave 1	0·497	0·247	0·247	0·000
2 Anxiety and depression at Wave 1	0·506	0·256	0·009	0·049
3 Subjective Memory Decline at Wave 1	0·506	0·256	0·001	0·514
Dependent variable: Episodic Memory Test at Wave 2				
1 Episodic Memory at Wave 1	0·477	0·227	0·227	0·000
2 Anxiety and depression at Wave 1	0·482	0·232	0·005	0·234
3 Subjective Memory Decline at Wave 1	0·485	0·236	0·004	0·133
Dependent variable: Symbol–Letter Modalities Test at Wave 2				
1 Symbol–Letter Modalities at Wave 1	0·701	0·492	0·492	0·000
2 Anxiety and depression at Wave 1	0·705	0·497	0·005	0·099
3 Subjective Memory Decline at Wave 1	0·705	0·497	0·001	0·479
Dependent variable: NART at Wave 2				
1 NART at Wave 1	0·837	0·700	0·700	0·000
2 Anxiety and depression at Wave 1	0·837	0·701	0·001	0·626
3 Subjective Memory Decline at Wave 1	0·837	0·701	0·000	0·643

Note: *N* varied for each analysis from 514 (MMSE) to 469 (NART).

showed that global complaints at Wave 1 did not predict dementia ($\chi^2 = 8{\cdot}82$, $P = 0{\cdot}07$) and nor did Subjective Memory Decline at Wave 1 ($\chi^2 = 1{\cdot}46$, $P = 0{\cdot}23$). Hierarchical logistic regressions, in which Wave 1 anxiety and depression were entered on the first step and Wave 1 complaints on the second step, showed a similar result. Anxiety and depression did not

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Table 3. *Association of global cognitive complaints with past change on cognitive tests: hierarchical regression predicting cognitive performance at Wave 2 from global complaints at Wave 2, controlling for performance at Wave 1 and anxiety and depression*

Predictor variables	*R*	R^2	R^2 change	*P*-value for change
Dependent variable: MMSE at Wave 2				
1 MMSE at Wave 1	0·481	0·231	0·231	0·000
2 Anxiety and depression at Wave 2	0·491	0·241	0·009	0·046
3 Global complaints at Wave 2	0·496	0·246	0·005	0·493
Dependent variable: Episodic Memory Test at Wave 2				
1 Episodic Memory at Wave 1	0·440	0·194	0·194	0·000
2 Anxiety and depression at Wave 2	0·459	0·211	0·017	0·006
3 Global complaints at Wave 2	0·473	0·224	0·013	0·104
Dependent variable: Symbol–Letter Modalities Test at Wave 2				
1 Symbol–Letter Modalities at Wave 1	0·700	0·490	0·490	0·000
2 Anxiety and depression at Wave 2	0·710	0·504	0·014	0·001
3 Global complaints at Wave 2	0·714	0·510	0·006	0·228
Dependent variable: NART at Wave 2				
1 NART at Wave 1	0·836	0·699	0·699	0·000
2 Anxiety and depression at Wave 2	0·836	0·700	0·001	0·623
3 Global complaints at Wave 2	0·837	0·701	0·001	0·787

Note: *N* varied for each analysis from 502 (MMSE) to 458 (NART).

Table 4. *Association of the Subjective Memory Decline Scale with past change on cognitive tests: hierarchical regression predicting cognitive performance at Wave 2 from Subjective Memory Decline Scale at Wave 2, controlling for performance at Wave 1 and anxiety and depression*

Predictor variables	*R*	R^2	R^2 change	*P*-value for change
Dependent variable: MMSE at Wave 2				
1 MMSE at Wave 1	0·511	0·261	0·261	0·000
2 Anxiety and depression at Wave 2	0·523	0·274	0·013	0·013
3 Subjective Memory Decline at Wave 2	0·524	0·274	0·001	0·506
Dependent variable: Episodic Memory Test at Wave 2				
1 Episodic Memory at Wave 1	0·453	0·205	0·205	0·000
2 Anxiety and depression at Wave 2	0·469	0·220	0·015	0·010
3 Subjective Memory Decline at Wave 2	0·475	0·226	0·006	0·066
Dependent variable: Symbol–Letter Modalities Test at Wave 2				
1 Symbol–Letter Modalities at Wave 1	0·700	0·489	0·489	0·000
2 Anxiety and depression at Wave 2	0·709	0·503	0·013	0·002
3 Subjective Memory Decline at Wave 2	0·709	0·503	0·000	0·587
Dependent variable: NART at Wave 2				
1 MMSE at Wave 1	0·840	0·705	0·705	0·000
2 Anxiety and depression at Wave 2	0·840	0·705	0·000	0·755
3 Subjective Memory Decline at Wave 2	0·841	0·707	0·001	0·160

Note: *N* varied for each analysis from 504 (MMSE) to 461 (NART).

predict dementia ($\chi^2 = 2{\cdot}92$, $P = 0{\cdot}32$) and neither global complaints nor the Subjective Memory Decline scale improved the model ($\chi^2 = 7{\cdot}38$, $P = 0{\cdot}12$, and $\chi^2 = 0{\cdot}48$, $P = 0{\cdot}49$ respectively).

Mortality

Of the 721 non-demented subjects with data on cognitive complaints at Wave 1, 122 were dead by Wave 2. In logistic regression analyses, global

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complaints at Wave 1 did not predict mortality ($\chi^2 = 4{\cdot}02$, $P = 0{\cdot}40$), but the Subjective Memory Decline Scale at Wave 1 did ($\chi^2 = 6{\cdot}70$, $P = 0{\cdot}01$). Each additional point on the Subjective Memory Decline Scale was associated with a 15% increase in the odds of dying. However, when Wave 1 anxiety and depression were entered as predictors before complaints, a different result was found. Anxiety and depression predicted mortality ($\chi^2 = 11{\cdot}83$, $P = 0{\cdot}003$), but neither global complaints nor the Subjective Memory Decline scale improved the model ($\chi^2 = 3{\cdot}01$, $P = 0{\cdot}56$, and $\chi^2 = 2{\cdot}46$, $P = 0{\cdot}12$ respectively).

DISCUSSION

This study found that cognitive complaints did not predict cognitive change over the following three and a half years, neither did they relate to cognitive change over the previous three and a half years, once anxiety and depression symptoms were statistically controlled. Similarly, cognitive complaints do not predict future dementia. These results held whether cognitive decline was measured using a dementia screening test or tests of episodic memory or mental speed, all of which are sensitive to ageing effects. The findings also held whether complaints were assessed using global questions or using specific questions about everyday memory performance. The findings are consistent with the results of most of the previous cross-sectional and longitudinal studies on the issue, but they contrast with Tobiansky *et al.*'s (1995) finding that complaints predicted future dementia. This discrepancy is difficult to account for.

One positive finding was that anxiety and depression are associated with past (but not future) cognitive decline. Because they did not predict future decline, it is unlikely that anxiety and depression occurred as a reaction to the onset of decline. A more plausible interpretation is that anxiety and depression cause reversible cognitive decline (c.f. Tarbuck & Paykel, 1995). Given that cognitive complaints are related to anxiety and depression, it is not surprising that complaints also had a small relationship to past decline when anxiety and depression were not controlled. These findings show the importance of controlling for anxiety and depression in studies of the validity of cognitive complaints.

Cognitive complaints were also found to have no relationship to mortality over the following three and a half years, once anxiety and depression were statistically controlled. This result contrasts with the common finding that low scores on cognitive tests are a predictor of mortality (e.g. Jorm *et al.* 1991; Berr *et al.* 1994; Swan *et al.* 1995). However, anxiety and depression symptoms were themselves associated with higher mortality and, accordingly, there was a small relationship between complaints and mortality when these symptoms were not controlled.

Taking the present findings together with our previous ones (Jorm *et al.* 1994), it appears that cognitive complaints result from a negative evaluation of cognitive performance and are not associated with either past or future cognitive decline. The results suggest that it is inappropriate to include cognitive complaints in diagnostic criteria for proposed disorders like age-associated memory impairment (Crook *et al.* 1986), mild cognitive disorder (World Health Organization, 1993) and ageing-associated cognitive decline (Levy, 1994). While all these disorders involve other criteria, Christensen *et al.* (1995) have demonstrated that complaints of impairment play a crucial role in determining if a person fulfils the current diagnostic criteria for mild cognitive disorder. If, as our results suggest, complaints reflect the affective state of the individual rather than actual cognitive decline, the validity of these classifications must suffer.

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