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EUROPEAN JOURNAL OF PUBLIC HEALTH 1998; 8: 133–139

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Lifestyle, health status, coping and sociodemographic factors

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This study examines to what extent memory capacity is influenced by lifestyle, health or sociodemographic factors. The data were derived from the Maastricht Aging Study (MAAS), a large study carried out in The Netherlands. For the current study 1,673 people aged 24–88 years completed a postal survey on 'Health, Cognition, and Psychosocial factors'. The dependent variable was 'memory capacity' as measured by the Metamemory in Adulthood (MIA) questionnaire. The study shows that age, gender and coping abilities play an important role in influencing the variation in memory capacity. The lifestyle factors of smoking and mental activity also had a significant effect on memory capacity in certain age-specific subgroups. These results suggests that future research should focus on these variables as determinants of cognitive ageing.

Key words: cognitive ageing, lifestyle, perceived health status, meta-memory

A decline in memory capacity is one of the most common problems encountered in ageing populations. Although some degree of cognitive impairment is associated with ageing, there is still a great variability in cognitive performance between individuals.[1] This variance in performance increases with age. Yet, even the oldest age groups contain individuals who show no or only a small decrease in cognitive or intellectual performance when compared to younger individuals.[2]

In 1990, the University of Maastricht, The Netherlands, initiated the Maastricht Aging Study (MAAS).[3] The MAAS study is a large study which aims to collect information about individual patterns of cognitive ageing and the relative influence of biomedical and psychosocial factors, in order to identify determinants of normal ('non-pathological') cognitive ageing and risk factors for accelerated ('pathological') cognitive ageing. In the present study, we were primarily interested in subjective ageing, focusing on how people perceive and judge their cognitive performance.

Our aim was to determine to what extent differences in cognitive ageing can be explained by variation in lifestyle factors, perceived health status and sociodemographic factors.

LIFESTYLE FACTORS AND COGNITIVE AGEING

Human development is a continuous process of growth and decline, which affects both the physical capacity and the memory capacity of the individual. Although lifestyles in modern society have been well investigated, the relationship between lifestyle and cognitive ageing has hardly been studied. Health-related lifestyles comprise patterns of health-related behaviour, values and attitudes adopted by groups or individuals in response to their social, cultural and economic environment.[4–6]

Several studies have investigated whether it is possible to enhance the cognitive performance of elderly people by changing health-related lifestyle factors, such as smoking, drinking, physical and mental activity.[1] For instance, *smoking* has been reported to improve attention, learning, reaction time and problem solving. In particular, lifelong smoking has been reported to have a positive effect on Alzheimer's disease and Parkinson's disease.[7] However, because of methodological problems, some of the results are inconclusive, with some studies suggesting that there is an inverse relationship between smoking and memory capacity.[8] Hill[8] proposed that there are two contrasting effects of smoking, namely, a short-term effect that improves memory function in young and middle-aged adults and a long-term effect that causes impairment of memory function in old adults.

Alcohol consumption is related to a decrease in the function of tissues and organ systems, including the brain and several studies have shown that alcohol consumption affects cognition negatively.[9] However, an alternative explanation is that subjects with low intelligence start to drink earlier. Overall, studies show that heavy drinking is related to impairments in cognition.[10–12] To determine the direction of causality in the social drinking-cognition relationship, Arbuckle et al.[10] designed a long-term study to assess the effect of a person's drinking history on cognition. However, controlling for age, education, young adult intelligence and psychological distress they found only a modest relationship between greater lifetime drinking and poorer performance.

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Growing evidence also supports the view that *physical activity* and good nutritional status are important determinants of physical and cognitive functioning.[13] In a review Thomas et al.[14] concluded that exercise has a beneficial effect on memory capacity. Moreover, regular exercise may reduce the loss of cognitive functions seen in elderly subjects.[1] Physical activity is related to a good performance on cognitive measures[15] and the same is true for *mental activity*. For example, Houx and colleagues[16–18] found that poorly performing elderly subjects were over-represented among individuals who did not spend much time reading, playing sports and doing puzzles.

SOCIODEMOGRAPHIC FACTORS, PERCEIVED HEALTH STATUS AND COGNITIVE AGEING

Both lifestyle factors and cognitive ageing are influenced by sociodemographic components and the perceived health status of the respondent.[15,19–22] It is generally agreed that cognitive functioning declines with age.[1,11,15] Gender has also been shown to be related to intellectual performance, with older men having higher test scores than older women.[15] These gender differences are usually explained in terms of status markers such as educational training and occupational experience, inasmuch as the gender differences in the intellectual functioning of older adults of higher socioeconomic status are reduced or eliminated when men and women are matched for these variables. Socioeconomic status, as indicated by occupation and education, has been found to be positively related to better performance by older adults on psychometric measures of intelligence.[15]

In this study, the concept of 'health status' includes perceived health and coping. It is probable that people who perceive their health to be good and people who can cope with the demands of work, family and life in general have a better cognitive performance. In addition, several studies suggest that women, unlike men, tend to take steps to promote health.[20–23] Furthermore, people who have a partner tend to have more health-protective behaviour than people who live alone.[24]

The literature thus suggests that there is a correlation between lifestyle factors, sociodemographic factors (such as age, gender, work, living alone and education), perceived health status and cognitive ageing. There appears to be a positive relationship between smoking (by young and middle-aged adults), physical activity, mental activity and cognition, whereas alcohol consumption appears to have the opposite effect on cognitive ageing. We wanted to determine to what extent differences in cognitive ageing, assessed as memory capacity, can be explained by differences in lifestyle factors, perceived health status and sociodemographic factors. The research model we used is shown in *figure 1*.

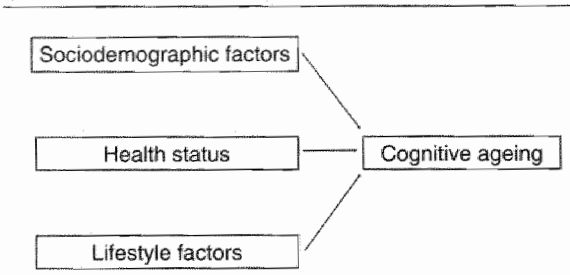

Figure 1 Research model

Sociodemographic factors: age, gender, work, living alone and education
Health status: perceived health and coping
Lifestyle factors: smoking, drinking, physical and mental activity
Cognitive ageing: level of memory capacity

METHODS

A multistage stratified random sampling design was employed to select study subjects. The initial sampling frame consisted of a registration network of general practitioners (RegistratieNet Huisartspraktijken, RNH).[25] The RNH registers contains the demographic and health characteristics of 63,283 patients which can be considered as representative for the population of the province of Limburg, e.g. the southern part of The Netherlands.[3] A stratified random sample (for age, gender, level of occupational ability and biological life events) of 3,941 subjects was drawn. Subjects were excluded from the study if they had a morbidity that is known to interfere with cognitive function, such as coma, cerebrovascular pathology, tumours of the nervous system, congenital deformations of the nervous system, multiple sclerosis, parkinsonism, epilepsy, dementia, organic psychosis, schizophrenia, affective psychosis and mental retardation. On the basis of these criteria 187 persons were excluded. Each general practitioner then personally invited (by letter) the selected people (n=3,754) in his or her practice to take part in the study. Informed consent was given by 2,340 people aged 24–88 years. Of these, 2,043 returned the questionnaire. The final study group, however, consists of 1,673 people who, on the basis of the guidelines on missing data specified in the survey, satisfactorily completed the postal questionnaire.

Non-response

A conservative non-response rate calculated from those subjects selected by the general practitioner to be eligible for entry to the study and those actually returning the mailed questionnaire was conducted. The non-response rate of 45% (1,711 non-responders, N=3,754) was found to be high enough to warrant a careful non-response analysis. A comparison of the response and non-response groups by age, gender, education and health status revealed that compliance in completing and returning the questionnaire increased up to the age of 65 years, and then decreased in the oldest age group (70–85 years).[3] Gender affected the participation rate, albeit only in the youngest and in the oldest age group. In the youngest age group a significantly higher percentage of women were willing to participate, whereas the opposite was true for the oldest age group. Participation was also strongly influenced by educational level, with subjects with a lower education level being less willing to cooperate than the other sub-

jects. Furthermore a small but significant difference in health status existed between the responders and non-responders in the oldest age group. To summarize the analysis, non-response was higher among younger low-educated males, older high-educated females and unhealthy persons. As a consequence, compared to the non-response group, the present study group can probably be characterized as a somewhat healthier, more educated and middle-aged group.

VARIABLES

The questionnaire was devised to measure factors related to health, cognitive and psychological functioning in a large population sample. Regarding sociodemographic factors and general health, questions were derived from several population surveys.[26–30] The questions regarding lifestyles were mainly selected or derived from existing questionnaires.[21,31,32] Cognitive ageing was measured by means of the Metamemory in Adulthood Questionnaire (MIA).[33–35] The quality of the questionnaire in terms of clearness and length was evaluated in a pilot study.[3]

The main dependent variable was memory capacity. The main independent variables were lifestyles, health status, coping ability and sociodemographic factors.

Dependent variable

- Memory capacity

Memory capacity was measured with the Metamemory in Adulthood Questionnaire (MIA), developed by Dixon and colleagues.[33,34] The MIA asks respondents to rate 108 statements describing their own memory functioning and their knowledge of general memory processes, on a 5-point Likert-scale. The MIA measures metamemory, a hypothetical higher-order process, which, in brief, refers to knowledge and beliefs about the functioning, development, limitations and capacities of i) one's own memory and ii) the human memory system.[33] The psychometric characteristics of this questionnaire have been studied in the United States, while the abridged version has been studied in The Netherlands[33]. The internal consistency (Cronbach's α) of the subscale 'capacity' ranges from 0.81 to 0.86.[34] Several studies have provided evidence of the convergent discriminant and predictive validity of the MIA when compared with other instruments such as the Memory Functioning Questionnaire (MFQ).[34] The questionnaire has been translated into Dutch, abridged and validated by Ponds and Jolles.[35] The factor structure of the Dutch MIA corresponds to that of the original MIA. Furthermore, the internal consistency of the Dutch MIA is high and the test-retest stability is satisfactory.[35] Because we were primarily interested in the perception of memory, as indicated by reports of performance on given tasks and were less interested in the other subscales of the MIA, which focus on knowledge of memory functioning, changes over time and achievement, we included questions about memory capacity in everyday life. Capacity refers to beliefs regarding one's memory capacity with items such as 'I am good at remembering names' and 'I am good at remembering the order in which events occur'. For a complete overview of the 12 items in the memory capacity scale see the *appendix*.

Independent variables

- Lifestyle variables

Lifestyle variables were derived from several health surveys.[21,31,32] Respondents were asked whether they currently smoked tobacco or consumed alcohol. The variables were dichotomized (1=yes and 0=no). If respondents answered 'yes', they were asked to indicate the number of cigarettes, cigars and pipes smoked per day and the number of glasses of alcohol drunk per day. Of the total group of responders, 68% did not smoke and 21% did not drink alcohol. Respondents were also asked how many hours per week they undertook mental and physical activities. For physical activity, respondents were asked how many hours they played sport or took part in other physical activities. A sum score was computed for mental activity and included the number of hours respondents played checkers or chess, solved puzzles and read books or magazines. On average, people spent 1.8 h. a week (SD 3.3) on physical activities and 10.3 h. a week (SD 8.3) on mental activities.

- Sociodemographic factors

Sociodemographic factors included age, gender, occupational activity, level of education and whether the respondent was living alone or not. The sample included people aged between 24 and 88 years (average 52 years). Age was categorized into three classes: 44 years and younger, 45–64 years and 65 years and older. Gender was coded as 1=male and 2=female. More women than men participated in the study (54 and 46%) and most of the older respondents were women. There were six categories of education, i.e. basic education (17%), junior vocational training (25%), junior secondary training (18%), senior vocational training (15%), senior secondary education/pre-university education (6%), and vocational colleges/university education (20%). The variable occupational activity was dichotomized into paid employment (code=1, 49%) or no paid employment (code=0, 51%).

As we were more interested in how people really lived and not in how they are registered officially, we did not look at marital status, but instead at living arrangements. Married couples, families, single-parent families, people who lived in a home or who had lodgers were regarded as cohabiting in a social unit. The emphasis of this study was on the distinction between people who cohabited and people who were living alone. Thirteen per cent of the respondents were living alone.

- Perceived health status and coping ability

Perceived health status is an integrative concept that reflects an individual's assessment and evaluation of his/her general health. Perceived health status was measured by the mean score (range 1–5) of three commonly used Likert-type questions, namely i) 'How do you perceive your health?', ii) 'How do you perceive your health in comparison with that of other people of your age?' and iii) 'How do you perceive your health in comparison to

one year ago?' (1=poor and 5=excellent).[23] The average score was 9.9 (SD 1.5 and range 1–15).

Coping ability refers to the ability to stand up to the demands of life and was also determined from the mean score for three questions: i) 'Can you meet the demands of strong physical exertion (e.g. walking stairs, running)?', ii) 'Can you stand up to the demands of work, family, and life circumstances?' and iii) 'Can you meet the demands of strong mental exertion (e.g. working, reading, talking and concentrating for a long time)?'. The mean score for coping ability was 5.3 (SD 0.9 and range 3–6). The α reliability coefficient was a moderate 0.61.

STATISTICAL ANALYSES

An initial screening was done of candidate independent variables for subsequent multiple stepwise regression analysis by inspecting their correlation with memory capacity. The variables were then entered into the hierarchical stepwise regression models to determine which of the selected lifestyle, health status and sociodemographic variables were related to problems with memory capacity controlling for the other selected variables. Categorical and ordinal variables were transformed into dummies to conduct the regression analysis using the procedures recommended by Darlington[36] for constructing dichotomous regressors. The initial screening indicated that perceived cognitive functioning was influenced by ageing (*table 1*). For the regression analyses, we therefore distinguished between young adults (44 years and younger), middle-aged adults (45–64 years) and old adults (65 years and older). Overall, the explained variance of the age-related associations appeared to be relatively small, but tended to be systematic in their effect. Separate regression analyses were then done for each age-specific group. In the regression analysis, groups of variables were entered in hierarchical order starting with i) sociodemographic factors, ii) health status and coping factors and iii) lifestyle factors. Cognitive capacity was the dependent variable. Interpretation was based on examining the F and R^2 values at each step. Changes in these statistics both for each variable and each variable class were considered in interpreting the three age-specific models.

RESULTS

Table 2 shows the results of the stepwise regression analysis for the three age-specific groups. As age increased the positive perceived health status was increasingly associated with higher ratings of memory capacity. In all age groups, women had a higher score for perceived cognitive functioning and for all age groups, coping ability had the greatest effect on perceived cognitive functioning in particular for the middle age group. In the youngest age group, respondents who undertook cognitive activities, that is those who frequently read books or journals, played mental exercises (checkers, chess or puzzles), tended to be more positive about their memory capacity than their less active counterparts. Smoking was positively related to memory capacity in young and middle-aged adults. Surprisingly, people who were physically more active in the middle-aged group tended to rate their memory capacity lower. In the oldest age group, coping ability, perceived health and female gender had a strong association with cognitive competence. Finally, in all age groups the increase in explained variance after adding the lifestyle factors to the model are small.

CONCLUSIONS AND DISCUSSION

The main conclusion of our study is that coping abilities play an important role in influencing the variation in memory capacity. Coping ability is a strong and consistent predictor of perceived cognitive capacity across all age groups. The lifestyle factors of smoking and mental activity (and to some degree physical activity) also had a significant effect on memory capacity within certain age-specific subgroups. For the middle-aged adults smoking was the lifestyle variable most (positively) related to memory capacity (physical activity had a slight negative effect) while mental activity was the only lifestyle variable (positively) related for the youngest age group.[7–12] Gender had a strong relationship to memory capacity for the older age group with women reporting a higher capa-

Table 1 Zero-order correlation (Pearson's r) of all variables; n=1,673

		1	2	3	4	5	6	7	8	9	10	11	12
1	Age	–											
2	Gender	–0.02	–										
3	Living alone	0.22**	0.12**	–									
4	Education	–0.37**	–0.11**	–0.00	–								
5	Paid employment	–0.41**	–0.25**	–0.08**	0.28**	–							
6	Perceived health	–0.11**	–0.03	0.00	0.19**	0.15**	–						
7	Coping ability	–0.32**	–0.08**	–0.09**	0.28**	0.23**	0.48**	–					
8	Smoking	–0.11**	–0.06*	–0.03	–0.04	0.04	–0.13**	–0.00	–				
9	Drinking	–0.23**	–0.23**	–0.09**	0.23**	0.19**	0.14**	0.22**	0.06*	–			
10	Physical activity	–0.04	–0.15**	–0.02	0.06**	0.06	0.16**	0.15**	–0.07*	0.08**	–		
11	Mental activity	0.26**	0.01	0.16**	0.11**	–0.12**	–0.00	–0.00	–0.03	–0.01	0.05	–	
12	Memory capacity	–0.16**	0.09**	–0.02	0.05	0.01	0.16**	0.27**	0.05	0.00	0.01	–0.03	–

* p<0.05, ** p<0.01 (two-tailed significance test)

city. The same gender-specific relationship was found in the middle age group, but not as strong.

It has been maintained that 'gerontologists have a natural interest in the ways in which ageing individuals cope with the characteristic stressors of each phase of the life span' (p. P161).[37] Our results support the proposition that this natural interest be reinforced by focused attention to the role of coping in specific age groups. While we found coping to be consistently important across all age groups, it is relatively least important for the elderly age group where perceived health has almost the same effect. This is neither the case for the middle-aged nor younger age groups. In these groups, coping clearly has the determinant function and perceived health appears to be taken for granted. In particular, in the middle age group more research is needed on the role of coping on memory capacity because this may be able to identify some social behavioural variables which can be targeted to prevent cognitive decline as ageing proceeds. Consistent with research on the effect of coping strategy on other health-related variables it also appears strongly related to memory capacity.[38] In the field of cognition, coping has been found to be related to intellectual functioning.[39] People who are more resilient to the demands of work, family and everyday life also seem to have a higher perceived memory capacity.

The relationship between cognitive functioning and smoking behaviour that we found is in agreement with the results of other studies suggesting that smoking (nicotine) has a positive effect on cognitive functioning. It is important to note here, that the present measurement of current smoking supports several earlier studies in which lifetime smoking was investigated.[7,8]

Earlier studies also pointed to the beneficial effects of long-term mental activities for cognitive functioning.[21,33] Surprisingly, however, only in the youngest age group, was such a relationship found. Younger people who were mentally active appeared to have a better cognitive performance than their less active counterparts. Why this relationship was absent in the older age groups is unclear and should be a focus for further research in longitudinal designs.

Several final remarks should be made regarding the methods that were used. A first one concerns the relationship between gender and perceived cognitive functioning. Comparison of the different age groups suggests that women tend to judge their memory capacity higher than men do, in particular in the oldest age group. Because earlier research showed higher memory test scores for men than for women, the question can be raised whether the MIA questionnaire is gender biased. It may be that several items of the instrument may be more applicable to women. Such items are, for instance 'I am good at remembering birthdays' and 'I am good at remembering things like recipes'.

Because we were primarily interested in how people perceive and judge their cognitive performance, one also should keep in mind that the results of this study are based on self-reported data. Research has shown[15] that objective measures of memory and subjective memory are not quite the same. As the data were self-reported, they also might be biased by under-reporting, with regard to substance abuse, such as smoking and drinking.

Table 2 Hierarchical regression analysis on memory capacity (1 low capacity and 5 high capacity): sociodemographic factors, health status and lifestyles Pearson's zero-order correlation r, standardized regression coefficient β, proportion of explained variance in the final model R^2 (cumulative)

	Age group ≤44 years n=640				Age group 45–64 years n=623				Age group ≥65 years n=410			
	r	β	R^2	F	r	β	R^2	F	r	β	R^2	F
Gender (1 male, 2 female)	0.05	0.05			0.08	0.08*			0.16	0.18**		
Living alone (0 living alone, 1 cohabiting)	0.06	0.04			–0.05	–0.07			0.00	–0.05		
Education (1 lowest, 6 highest)	0.04	–0.00			–0.01	–0.03			0.00	–0.02		
Paid employment (0 unemployed, 1 employed)	–0.02	–0.04	0.00	1.56	–0.04	–0.05	0.01	1.92	–	–	0.02	4.13**
Perceived health (sum-score: 3 bad health, 15 good health)	0.12	0.02			0.13	0.05			0.21	0.13*		
Coping ability (sum-score: 3 no coping ability, 6 good coping ability)	0.23	0.22**	0.06	7.50**	0.26	0.28**	0.09	10.39**	0.23	0.19**	0.10	9.44**
Smoking (0 non-smokers, 1 smokers)	0.05	0.08			0.10	0.11**			–0.07	–0.01		
Drinking (0 drinkers, 1 total abstainers)	–0.03	–0.06			–0.02	–0.05			–0.03	–0.01		
Physical activity (hrs)	0.04	0.03			–0.06	–0.08*			0.00	–0.03		
Mental activity (sumscore hrs)	0.17	0.14**	0.09	6.72**	–0.03	0.04	0.11	8.03**	–0.03	–0.01	0.10	5.28**

* p<0.05, ** p<0.01

A final remark concerns the sampling procedure and low response rates. This not only resulted in a study group of cognitively healthy subjects but also set limits to the conclusions to be drawn beyond the group under study. Notwithstanding this, it should be stressed that the results from the present cross-sectional study were consistent with earlier research. Longitudinal studies, however, are needed in order to make conclusive statements about social predictors of cognitive functioning. For that purpose a three-year follow-up of the MAAS study will be carried out in the course of 1997. This should provide more definite answers and better insight into the effects of sociodemographic factors, health status and lifestyle factors on cognitive memory functioning.

NOTE

This paper was presented at the Annual Meeting of the European Public Health Association in Budapest, Hungary, 14–16 December 1995.

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Received 11 July 1996, accepted 6 June 1997

Appendix Items of the memory capacity scale of the metamemory in adulthood (MIA) questionnaire

Items

- I am good at remembering names
- I am good at remembering birthdays
- I am good at remembering the order in which events occurred
- I am good at remembering conversations that I have had
- I am good at remembering things like recipes
- I am good at remembering the titles of books, films or plays
- I have no trouble remembering the lyrics of songs
- I am good at remembering the names of musical selections
- After I have read a book I have no difficulty remembering factual information from it
- I am good at remembering the content of news articles and broadcasts
- Remembering the plots of stories is easy for me
- I am usually able to remember exactly where I read or heard a specific thing

Answering categories

- Agree strongly
- Agree
- Undecided
- Disagree
- Disagree strongly