Journal of Epidemiology and Community Health 1995;49:482-488

Health behaviours explain part of the differences in self reported health associated with partner/marital status in The Netherlands

I M A Joung, K Stronks, H van de Mheen, J P Mackenbach

Abstract

Study objective **– To describe the differences in health behaviours in disparate marital status groups and to estimate the extent to which these can explain differences in health associated with marital status.**

Design **– Baseline data of a prospective cohort study were used. Directly age standardised percentages of each marital group that engaged in each of the following behaviours – smoking, alcohol consumption, coffee consumption, breakfast, leisure exercise, and body mass index – were computed. Multiple logistic regression models were fitted to estimate the health differences associated with marital status with and without control for differences in health behaviours.**

Setting **– The population of the city of Eindhoven and surrounding municipalities (mixed urban-rural area) in The Netherlands in March 1991.**

Participants **– There were 16 311 men and women, aged 25–74 years, and of Dutch nationality.**

Main results **– There were differences in relation to marital status for each health behaviour. Married people were more likely to practise positive health behaviours (such as exercise and eating breakfast) and less likely to engage in negative ones (such as smoking or drinking heavily) than the other groups. Control for all six health behaviours could explain an average of 20–36% of the differences in perceived and general health and subjective health complaints.**

Conclusions **– Differences in health behaviours explained a considerable amount, but not all, of the health differences related to marital status. Longitudinal data are necessary to confirm these findings; to determine whether the differences in health behaviours related to marital status are caused by selection effects or social causation effects; and to learn how social control, social support, and stress inter-relate to reinforce negative or to maintain positive health behaviours.**

(*J Epidemiol Community Health* 1995;**49**:482–488)

Department of Public Health, Erasmus University Rotterdam, PO Box 1738, 3000 DR Rotterdam, The Netherlands
I M A Joung
K Stronks
H van de Mheen
J P Mackenbach

Correspondence to:
Dr I Joung.

Accepted for publication February 1995

In many western countries mortality and morbidity differences related to marital status have been reported.[1–10] Married people generally have the lowest mortality and morbidity rates while divorced people have the highest ones. In addition to differences in psychosocial factors and material circumstances, differences in health behaviours have been mentioned as possible explanations for the relationship between marital status and health, or, to widen the definition, the association between social relationships and health.[9 11–14]

The fact that there is a relationship between common health practices like smoking, drinking, regularity of meals, and physical activity on the one hand and physical health status on the other hand, has been known for many years.[15]

The association between marital status and health behaviours has also been described. In most studies it is found that marriage has a deterrent effect on negative health behaviours, such as smoking, excessive alcohol consumption, and other risk taking behaviour.[13 14 16–20] Only for studies concerning the relationship between marital status and obesity have the results been inconsistent.[21]

We know of only four studies that have looked at the inter-relationship between marital status, health behaviours, and health – and then only limited age ranges and/or only one sex were considered.[6 9 22 23] The extent to which health behaviours explained health differences related to marital status varied in the four studies from almost not at all to considerably. In all four the association between marital status and health remained significant after controlling for the health behaviours.

We have assessed the effect of several health behaviours on the health differences related to marital status and partner status for both men and women. We have considered a larger age range (25–74 years of age) than the four studies mentioned above. In addition, we decided not to focus on health differences in relation to marital status alone. In the past, marital status corresponded with a type of living arrangement – married people lived with their spouses; young people who had not married lived with their parents; and widowed, divorced, and older people who had not married lived on their own. During the past two decades this has changed. While most married persons still live with their spouse, the proportion of people living with a partner without being married is growing and the proportion of young people who have never married but have their own household has also increased. In a previous study we found that both partner status and marital status have a separate effect on health status.[10] As a result

Table 1 Coding of the variables for health status and health behaviours

Variable	*Categories*
Health status:	
Perceived general health (answers to the question "How is your health in general?")	"Very good" or "good" *v* "fair", "sometimes good and sometimes bad" or "bad"
Subjective health complaints (13 listed complaints such as headache, dizziness, tiredness)	Suffering from ≤3 complaints *v* suffering from >3 complaints
Chronic conditions (23 listed chronic conditions such as heart diseases, diabetes mellitus, rheumatoid arthritis)	Suffering from none *v* suffering from at least one of the chronic conditions in the past year
Health behaviours:	
Smoking	Never, former, only pipes or cigars, ≤20 cigarettes/d, >20 cigarettes/d
Alcohol consumption	None, low, moderate, excessive, very excessive
Coffee consumption	None, 1–4 cups/d, >4 cups/d
Breakfast	≥5 times/wk, <5 times/wk
Leisure exercise (hours spent on sports and/or gardening/cycling/walking[a])	None, <1 h/wk, 1–2 h/wk, ≥2 h/wk
Body mass index (weight in kg divided by height in m^2)	<20; 20–27; 27–30; >30

[a] Hours spent on gardening, cycling, or walking counted half, hours spent on sports counted full.

we decided not to concentrate on health differences in relation to either marital status or partner status alone in this study but instead constructed a variable that takes both marital status and partner status into account.

The study aimed to answer the following questions:

- What differences in health behaviours are seen between partner/marital status groups?
- To what extent can differences in health related to partner/marital status be explained by differences in health behaviours?

Methods

We have used the baseline data of the GLOBE study (the Dutch acronym for 'health and living conditions of the population of Eindhoven and surroundings'). The design and objective of this study are detailed elsewhere.[24] This prospective cohort study investigates the explanation of sociodemographic inequalities in health in The Netherlands in a mixed rural–urban area. For the study, a random sample of 27 079 persons with Dutch nationality and aged 15–74 years was drawn from the population registers of the city of Eindhoven and a number of surrounding municipalities. In the sample people older than 45 and those in the lowest and highest socioeconomic groups were over-represented. The baseline measurement took place in March 1991. All selected people were sent a postal questionnaire which included items on health status, health behaviour, and sociodemographic characteristics. The overall response rate was 70·1% (18 973 persons).

The analyses in this study were restricted to people aged 25 years and older (n = 16 311), because most of the younger people had never married. Analysis was performed separately for men and women.

HEALTH MEASURES AND BEHAVIOURS

The health measures used in the analyses were as follows: perceived general health, subjective health complaints, and chronic conditions.[10] The health behaviours used were: smoking, alcohol consumption, coffee consumption, breakfast, leisure exercise, and body mass index (BMI). The coding of these variables is shown in table 1.

INDEPENDENT VARIABLES

The independent variable in our analysis, based on both partner status and marital status (referred to as partner/marital status), was classified as:

(1) Married, living with a partner
(2) Never married, living with a partner
(3) Divorced, living with a partner
(4) Widowed, living with a partner
(5) Never married, single
(6) Divorced, single
(7) Widowed, single
(8) Other

People were classified irrespective of whether they had children or not, because in a previous analysis having children was not associated with health. Thus, divorced persons living with children but not with a partner are classified in group 6 and not in group 8. Group 8 mainly consists of never married persons living with their parents.

The variable partner/marital status was constructed by using a question concerning marital status and a question concerning living arrangement. Married persons skipped the question about living arrangement in the questionnaire. However, by combining the answers on questions about the number of people living in the house and the number of children living in the house we estimated that only 64 of 12 568 married persons (0·5%) were not living with their spouse. Data from The Netherlands Central Bureau of Statistics show that fewer than 1·3% of the married population is separated,[25] so separation is rare in The Netherlands and we can assume that the vast

Table 2 Study subjects (column percentages) in relation to partner/marital status and sex

Partner/marital status	*Sex*				*Total*	
	Men		*Women*		*No*	*(%)*
	No	*(%)*	*No*	*(%)*		
Partner:						
Married	6225	(78·9)	6220	(73·9)	12445	(76·3)
Never married	281	(3·6)	224	(2·7)	505	(3·1)
Divorced	126	(1·6)	93	(1·1)	219	(1·3)
Widowed	31	(0·4)	47	(0·6)	78	(0·5)
No partner:						
Never married	521	(6·6)	458	(5·4)	979	(6·0)
Divorced	329	(4·2)	522	(6·2)	851	(5·2)
Widowed	157	(2·0)	688	(8·2)	845	(5·2)
Other	222	(2·8)	167	(2·0)	389	(2·4)
Total	7892	(100·0)	8419	(100·0)	16311	(100·0)

Table 3 The multiple logistic regression models used

Model 1: health measure = f (age + sex + health behaviours)
Model 2: health measure = f (partner/marital status + confounders*)
Model 3: health measure = f (partner/marital status + confounders* + health behaviours)

* Age + educational level + degree of urbanisation + religion + country of birth

majority of the married persons in our study is living with their spouse.

In table 2 the study population is shown in relation to our variable partner/marital status and sex.

STATISTICS

To find out whether there are differences in health behaviour between the partner/marital status groups, we computed directly age standardised percentages indicating the percentage of each partner/marital status group that engaged in each health behaviour.

To determine the extent to which health differences associated with partner/marital status groups could be explained by differences in health behaviour, we used multiple logistic regression models.[26] Separate models were fitted for each health measure using *SPSS*. All variables were coded as dummy variables. The regression coefficients of the variables and their standard errors were used to calculate odds ratios (ORs) with 95% confidence intervals. In the results section we also show the change in deviance and its p value that resulted from including the health behaviours in model 1 and partner/marital status in models 2 and 3, in order to give an indication of the overall significance level of the variable in the model. The models used are shown in table 3.

To determine whether the known relationships between the health behaviours and health could be reproduced with our data, we fitted models containing age (five year categories), sex, and all six health behaviours (model 1).

Next, we determined what the relationship was between the partner/marital status variable and the health measures by fitting logistic regression models (model 2) containing partner/marital status as the independent variable and variables for the following confounders: age, educational level (seven categories), degree of urbanisation (five categories), religion (four categories), and country of birth (Netherlands, abroad).

Finally, we fitted models containing partner/marital status, the confounders, and all health behaviour variables (model 3). The change in ORs of partner/marital status was examined (change in ORs between model 2 and model 3). We tested whether the change in ORs caused by adding all health behaviours to the model was statistically significant using the Wald type collapsibility test.[27]

Results

Table 4 shows the standardised percentages of the partner/marital status groups that engaged in the different health behaviours. In the table we show only one category for each health behaviour as an example (data for the other categories are available on request). Differences associated with partner/marital status were found for each health behaviour. Married people were more likely to practise positive health behaviours and less likely to engage in negative health behaviours than the other groups. Differences in health behaviour were also found between the other partner/marital status groups but there was no group that consistently engaged in more positive health behaviours than the others.

HEALTH BEHAVIOURS

Smoking

In both men and women, married people were least likely and divorced people most likely to be current smokers. Married men and never married men living with a partner comprised the greatest number of former smokers (43%), as did married and divorced women living with a partner (30%). The percentages of never smokers were highest in the never married

Table 4 Differences in health behaviour in relation to partner/marital status and sex (directly standardised percentages)

	Smoking (>20 cigarettes/d)	*Alcohol (Very excessive)*	*Coffee (>4 cups/d)*	*Breakfast/wk (<5 times/wk)*	*Leisure exercise (None)*	*Body mass index (>30 kg/m²)*
Men						
Partner:						
Married	6·9	5·0	62·5	14·1	5·1	4·5
Never married	10·6	8·6	63·9	31·9	3·0	8·9
Divorced	15·5	10·8	68·7	25·5	10·9	4·8
Widowed*	—	—	—	—	—	—
No partner:						
Never married	9·6	6·6	50·9	23·9	4·8	5·8
Divorced	17·9	9·2	57·3	23·4	6·1	6·3
Widowed	12·6	8·5	48·4	11·1	7·0	6·2
Other	22·9	14·2	54·4	26·4	4·8	9·8
Women						
Partner:						
Married	4·7	0·7	44·3	10·7	5·1	8·2
Never married	2·9	0·0	34·5	17·1	5·8	4·2
Divorced	9·6	1·9	55·0	19·0	6·2	6·6
Widowed*	—	—	—	—	—	—
No partner:						
Never married	7·0	0·2	39·9	17·5	4·7	9·3
Divorced	13·9	1·2	39·4	21·9	5·8	11·7
Widowed	9·4	1·7	48·9	15·4	7·0	12·3
Other	5·5	0·0	43·2	11·4	5·3	8·6

* Since there were only a small number of widowed men and women living with a partner in our study we did not calculate the directly standardised percentages for them.

Table 5 The association between the health behaviours and health (model 1: health measure = f (age + sex + smoking + alcohol consumption + coffee consumption + breakfast + leisure exercise + BMI)

	Health measure					
	Perceived general health		*Subjective health complaints*		*Chronic conditions*	
Smoking:						
Never	1·00		1·00		1·00	
Former	1·35	(1·21, 1·50)	1·32	(1·20, 1·46)	1·49	(1·36, 1·64)
Pipe/cigars	1·39	(1·10, 1·76)	1·34	(1·07, 1·68)	1·17	(0·96, 1·44)
1–20 cig/d	1·75	(1·56, 1·96)	1·71	(1·54, 1·89)	1·29	(1·17, 1·43)
>20 cig/d	2·01	(1·69, 2·38)	2·37	(2·01, 2·78)	1·43	(1·23, 1·67)
Δ deviance*		113·558		155·214		78·995
p value†		0·0000		0·0000		0·0000
Alcohol consumption:						
None	1·00		1·00		1·00	
Low	0·51	(0·46, 0·57)	0·67	(0·61, 0·74)	0·76	(0·69, 0·83)
Moderate	0·40	(0·35, 0·45)	0·54	(0·48, 0·60)	0·66	(0·59, 0·74)
Excessive	0·49	(0·41, 0·60)	0·32	(0·27, 0·39)	0·73	(0·62, 0·87)
Very excessive	0·48	(0·38, 0·60)	0·64	(0·51, 0·80)	0·67	(0·54, 0·83)
Δ deviance*		253·455		123·381		59·600
p value†		0·0000		0·0000		0·0000
Coffee consumption:						
None	1·00		1·00		1·00	
1–4 cups/d	0·63	(0·53, 0·75)	0·70	(0·59, 0·81)	0·84	(0·72, 0·98)
>4 cups/d	0·54	(0·45, 0·64)	0·59	(0·51, 0·70)	0·74	(0·64, 0·87)
Δ deviance*		51·943		45·684		19·576
p value†		0·0000		0·0000		0·0001
Breakfast:						
≥5 times/wk	1·00		1·00		1·00	
<5 times/wk	1·15	(1·02, 1·29)	1·18	(1·06, 1·31)	1·02	(0·92, 1·13)
Δ deviance*		5·195		8·829		0·134
p value†		0·0226		0·0030		0·7142
Leisure exercise:						
>2 h/wk	1·00		1·00		1·00	
1–2 h/wk	1·66	(1·38, 2·00)	1·43	(1·20, 1·71)	1·15	(0·96, 1·36)
<1 h/wk	2·18	(1·90, 2·49)	1·94	(1·71, 2·20)	1·28	(1·13, 1·44)
None	3·63	(3·29, 3·99)	2·47	(2·27, 2·69)	1·56	(1·44, 1·69)
Δ deviance*		261·373		171·674		35·124
p value†		0·0000		0·0000		0·0000
Body mass index:						
<20	1·19	(1·01, 1·41)	1·07	(0·92, 1·25)	1·08	(0·94, 1·25)
20–27	1·00		1·00		1·00	
27–30	1·43	(1·28, 1·59)	1·34	(1·20, 1·48)	1·30	(1·17, 1·44)
>30	1·93	(1·66, 2·25)	1·78	(1·53, 2·06)	1·51	(1·30, 1·75)
Δ deviance*		98·929		78·164		49·667
p value†		0·0000		0·0000		0·0000

* Change in deviance of the model due to adding the specific health behaviour variable to a model without this variable
† The overall significance of the specific health behaviour variable in the model

without a partner and 'other' category for men and in the married and 'other' categories for women.

Alcohol

There were fewer teetotallers among those living with a partner than among those not living with a partner. Married and never married people without a partner were least likely to drink (very) heavily.

Coffee

Never married men without a partner and the two categories of never married women were the most likely never to drink coffee.

Breakfast

Married men and widowed men without a partner and married women and women in the category 'other' ate breakfast most regularly.

Leisure exercise

Among the men, those living with a partner took more exercise in their leisure time than the other groups. With regard to women, the never married living with a partner group had the highest percentage of subjects who took more than two hours' leisure exercise, followed by the married women.

Body mass index

Married men showed the highest percentage of people with a normal weight. The percentage of married women who were overweight (BMI>27: 21%) was intermediate, and widowed women without a partner showed the highest percentage overweight (28%). Only 8% of the never married women living with a partner were overweight, but 27% of this group were underweight (compared with only 8–11% of the other female groups).

Table 5 shows the relationships between the health behaviours and health measures in our study. The results of the separate analyses for men and women were similar to those presented in table 5. For all six health behaviours we found a statistically significant association with the health measures, except for breakfast and chronic conditions. In general, the relationships in our data between the specific health behaviours and health were consistent with those described in other studies. For the association between alcohol consumption and health, however, we did not find the frequently described U-shaped relationship (more health problems among teetotallers and excessive drinkers). We found instead that only teetotallers had most health problems, which has also been reported for the 1992 *General Household Survey* of the OPCS.[28]

Table 6 shows the influences of the health behaviours on the relationship between partner/marital status and perceived general health,

Table 6 Differences in health in relation to partner/marital status and sex. Odds ratios with 95% confidence intervals for models 2 and 3

	Perceived general health				*Subjective health complaints*				*Chronic conditions*			
	Model 2: confounders + partner/marital status		*Model 3: confounders + partner/marital status + health behaviours*		*Model 2: confounders + partner/marital status*		*Model 3: confounders + partner/marital status + health behaviours*		*Model 2: confounders + partner/marital status*		*Model 3: confounders + partner/ marital status + health behaviours*	
Men												
Partner:												
Married	1·00		1·00		1·00		1·00		1·00		1·00	
Never married	1·41	(0·95, 2·08)	1·33	(0·89, 1·98)	1·69	(1·24, 2·31)	1·57‡	(1·14, 2·17)	0·99	(0·73, 1·33)	0·96	(0·70, 1·30)
Divorced	1·45	(0·95, 2·22)	1·32	(0·85, 2·05)	1·96	(1·33, 2·90)	1·76‡	(1·17, 2·63)	1·03	(0·70, 1·51)	1·02	(0·69, 1·51)
Widowed	1·50	(0·67, 3·36)	1·34	(0·58, 3·09)	0·99	(0·44, 2·26)	0·85	(0·37, 1·98)	0·91	(0·43, 1·93)	0·83	(0·39, 1·78)
No partner:												
Never married	2·15	(1·69, 2·75)	1·94‡	(1·51, 2·49)	1·42	(1·13, 1·78)	1·25‡	(0·99, 1·58)	1·09	(0·88, 1·36)	1·06	(0·85, 1·33)
Divorced	2·43	(1·88, 3·14)	2·18‡	(1·67, 2·84)	2·22	(1·73, 2·85)	1·97‡	(1·52, 2·54)	1·33	(1·04, 1·70)	1·31	(1·02, 1·68)
Widowed	1·47	(1·00, 2·14)	1·37	(0·93, 2·03)	1·33	(0·91, 1·93)	1·21‡	(0·82, 1·78)	0·90	(0·62, 1·30)	0·88	(0·61, 1·26)
Other	2·13	(1·48, 3·06)	1·97	(1·36, 2·86)	1·17	(0·83, 1·64)	1·03‡	(0·73, 1·47)	1·07	(0·77, 1·47)	1·06	(0·76, 1·46)
Δ deviance*		89·180		62·402		61·370		39·914		6·197		5·619
p value†		<0·0001		<0·0001		<0·0001		<0·0001		0·5170		0·5849
Women												
Partner:												
Married	1·00		1·00		1·00		1·00		1·00		1·00	
Never married	1·12	(0·75, 1·69)	1·12	(0·74, 1·70)	1·32	(0·96, 1·82)	1·32	(0·95, 1·83)	0·81	(0·59, 1·11)	0·81	(0·59, 1·12)
Divorced	1·77	(1·09, 2·88)	1·65	(1·00, 2·74)	1·32	(0·83, 2·09)	1·20	(0·75, 1·93)	0·97	(0·62, 1·52)	0·94	(0·60, 1·48)
Widowed	1·00	(0·51, 1·97)	1·03	(0·51, 2·07)	1·15	(0·61, 2·17)	1·17	(0·61, 2·24)	0·74	(0·39, 1·39)	0·74	(0·39, 1·40)
No partner:												
Never married	1·36	(1·05, 1·76)	1·23‡	(0·95, 1·60)	1·34	(1·07, 1·68)	1·24‡	(0·98, 1·56)	1·30	(1·04, 1·62)	1·30	(1·04, 1·63)
Divorced	2·03	(1·63, 2·52)	1·74‡	(1·39, 2·19)	1·73	(1·41, 2·13)	1·50‡	(1·21, 1·85)	1·44	(1·17, 1·77)	1·37‡	(1·11, 1·70)
Widowed	0·88	(0·72, 1·09)	0·84	(0·67, 1·04)	1·02	(0·84, 1·25)	0·97	(0·79, 1·19)	0·81	(0·67, 0·99)	0·81	(0·66, 0·99)
Other	1·17	(0·80, 1·71)	1·04‡	(0·70, 1·52)	0·97	(0·68, 1·38)	0·87	(0·61, 1·25)	1·00	(0·71, 1·41)	0·96	(0·68, 1·36)
Δ deviance*		50·102		30·915		34·219		19·545		26·285		22·729
p value†		<0·0001		0·0001		<0·0001		0·0066		0·0004		0·0019

* Change in deviance of the model due to adding the variable partner/marital status to a model without this variable.
† The overall significance of the variable partner/marital status in the model, based on a comparison of Δ deviance with a χ^2 distribution with 7 df.
‡ According to the Wald type collapsibility test the change in OR between models 2 and 3 is statistically significant ($p<0·05$).

subjective health complaints, and chronic conditions. The ORs (95% confidence intervals) for the partner/marital status groups for models 2 and 3, are shown together with the changes in deviance in models 2 and 3 that resulted from adding the variable partner/marital status to a model without this variable and the overall significance of the variable partner/marital status in the models.

With regard to the relationship between partner/marital status and health, there were significant differences associated with partner/marital status for all health measures except chronic conditions for men (models 2 in table 6). There were large differences in perceived general health associated with partner/marital status. Unmarried men who lived with a partner had an OR of ± 1·50 and never married and divorced men not living with a partner had ORs of more than 2·00. Divorced women living with a partner and those not living with a partner had ORs of 1·77 and 2·03 respectively. The differences in subjective health complaints by partner/marital status are also large. The differences in chronic conditions among women are relatively small, only the ORs of never married and divorced women who live without a partner are higher than 1·00. For all three health measures divorced persons (both men and women) who did not live with a partner had the highest ORs.

Adding only one health behaviour to model 2 generally resulted in a significant improvement of the model, but did not usually result in large changes in the ORs of partner/marital status (data not shown). The variables for smoking, alcohol consumption, and leisure exercise caused the largest changes in ORs.

When the ORs of model 3, containing variables for all health behaviours (results of models 3 in table 6), were compared with those of model 2 there was a decrease in the ORs of perceived general health and subjective health complaints for almost all male partner/marital status groups. The decreases in ORs were statistically significant at the 0·05 level for most male partner/marital groups for the subjective health complaints but only for the never married and divorced men living without a partner with regard to perceived general health. Among women a different pattern was seen. Controlling for health behaviours had hardly any effect on the ORs of never married women living with a partner or widowed women. The ORs of never married and divorced women living without a partner, however, showed a statistically significant decrease, both for perceived general health and subjective health complaints. Adding all health behaviours to the model for chronic conditions for women caused hardly any changes in the ORs of partner/marital status. A significant decline in the OR was seen only for divorced women not living with a partner.

On average, the *increased* ORs of the unmarried partner/marital status groups decreased by 22% for men and 31% for women for general perceived health and by 36% and 20% respectively for subjective health complaints. It is remarkable that controlling for the health behaviours reduced the ORs but did not change the overall pattern of health differences between the partner/marital status groups. For instance divorced people (both men and women) who do not live with a partner still had the highest OR for all health measures after controlling for the health behaviours.

Discussion

We found differences associated with partner/marital status for each health behaviour. Married people were more likely to engage in positive health behaviours (such as exercise and

eating breakfast) and less likely to engage in negative health behaviours (such as smoking or drinking heavily) than the other groups. Differences in health behaviour were also found between the other partner/marital status groups but none of these consistently engaged in more positive health behaviours than the others. Control for only one health behaviour did not result in any large reductions in the health differences. Control for all six health behaviours explained, on average, 20–36% of the health differences in perceived general health and subjective health complaints but not the differences in chronic conditions among women (the differences in chronic conditions in relation to partner/marital status in men were not statistically significant). Our results suggest therefore that health behaviours explain a considerable proportion of the health differences associated with partner/marital status – but certainly not all differences.

Our results are based on self reported data. The accuracy of information on health behaviours obtained from questionnaires is known to vary.[21 29–31] However, this could only bias the result if there were systematic differences related to partner/marital status in the response to questions concerning health behaviours or health. This does not seem likely.

In our study we controlled for the cumulative effects of six health behaviours on the relationship between partner/marital status and physical health. We have also fitted models in which interaction terms for the health behaviours were added to the full model, in order to determine whether more of the health differences could be explained by the health behaviours in our study (results not shown). This did not prove to be the case. It is likely, however, that extra control for other health behaviours such as hours' sleep (not available in our study) and food habits (only available for a subsample of study population) would increase the proportion of the health differences explained by health behaviours.

Of the studies describing the relationship between marital status, health behaviours, and health status mentioned in the introduction, those of Davis *et al*, Rosengren *et al*, and Ben-Shlomo *et al* are longitudinal studies, with mortality as a health measure, and are therefore difficult to compare with our study.[6 22 23] The study of Wyke and Ford lends itself best to comparison with our study,[9] despite important differences in study population, variable definitions, etc, which complicate the comparison. The study of Wyke and Ford is a cross sectional study of 1042 people of 55 years of age. In that study smoking and drinking respectively could explain 25% and 10% of the differences in self rated health among women, 20% and 0% of the differences in self rated health among men, and 1% and 1% of the differences in the number of chronic conditions among women (for men there were no statistically significant differences in the number of chronic conditions). It is striking that both Wyke and Ford's results and ours showed that health behaviours had some effect on the relationship between marital status and self rated general health but hardly any effect on the relationship between marital status and chronic conditions.

Since both this and Wyke and Ford's studies used cross sectional data, it is possible that health influenced health behaviours. Health problems could have forced people to adjust their health behaviours. For example, those who had had a heart attack could have quit smoking and started a diet or regular exercise on their doctor's advice. It is more likely that this occurred in those suffering from severe health problems, which could explain why the health behaviours explain so little of the differences in chronic conditions. This hypothesis is supported by the fact that we found that former smokers had ORs between those of the never smokers and current smokers for perceived general health and subjective health complaints but had the highest ORs for chronic conditions, and by the fact that teetotallers had more health problems than drinkers (table 4). That health might have influenced health behaviours is a disadvantage of working with cross sectional data. Longitudinal data are necessary to estimate the extent to which differences in chronic conditions related to partner/marital status can be explained by health behaviours and to adjust our estimates of perceived general health and subjective health complaints to take into account the influence of health on health behaviours.

Another disadvantage of cross sectional data is that we cannot locate the place of health behaviours in the relationship between partner/marital status and health. There are several possibilities for the causal pathways between marital status, health behaviours, and physical health. Firstly, partner/marital status could depend on health behaviours (selection), which is especially possible for alcohol consumption. Heavy drinkers probably have less chance of marrying, and heavy drinking while married could cause or contribute to divorce. However, Miller-Tutzauer *et al*, in a three year follow up study of 18–25 year olds, found that people two years before marriage did not differ in drinking behaviour from those who remained single. They therefore concluded that the findings did not suggest pre-existing differences in alcohol consumption between those who marry and those who do not.[17]

Secondly, health behaviours could be an intermediate in the causal pathway between marital status and health. In this view health depends on partner/marital status. This is the so called social causation theory or protection theory.[5 9 11 13 14 20] Partner/marital status could affect health behaviour through social control (telling or reminding someone to engage in certain health behaviours), social support (support when changing health behaviour), and/or stress. Umberson found strong suggestions that married women especially attempt to affect the health behaviour of their spouses and that 'over time, social control may have some beneficial consequences for health behaviour among those individuals who remain married'.[14] Partner support has been found to be beneficial to smoking cessation maintenance,[32–35] which is also consistent with

the larger proportions of former smokers in our study among married people and those with a partner. Finally, stress from the loss of a partner due to divorce or bereavement, or stress from the negative attitude of society to divorced/single people could increase negative health behaviours (smoking and drinking as palliative coping responses).[14 36] If all three mechanisms operate, they are likely to reinforce each other.

Both possibilities could be present in our study. Further research is necessary to estimate the relative importance of selection and social causation effects in differences in health behaviours in relation to partner/marital status, and to learn how social control, social support, and stress interrelate to reinforce negative or maintain positive health behaviours. For this, longitudinal data are required. If it is found that social causation effects are responsible for the differences in health behaviours by partner/marital status, there may be opportunities for preventive actions. For instance health education programmes especially directed at newly separated (both divorced people and those whose consensual union has been dissolved), or widowed persons and aimed at preventing them from changing their health behaviours for the worse could be organised. These groups might also be approached to participate in training courses in stress management run by local public health services.

We conclude that health behaviours may explain a considerable proportion – but certainly not all – of the health differences associated with partner/marital status. Further research using longitudinal data is required to confirm these findings and to learn how to reduce the health differences caused by differences in health behaviours. The explanation of the remaining health differences related to partner/marital status also requires further research which could be directed at differences in psycho-social factors and material circumstances.

This project is supported financially by the Priority Programme on Population Research of the Netherlands Organization for Specific Research ('NWO'). It is part of the GLOBE study ('Gezondheid en Levensomstandigheden Bevolking Eindhoven en omstreken'), which is a study on "Health and Living Conditions of the Population of Eindhoven and surroundings". The GLOBE-study is undertaken by the Department of Public Health, Erasmus University Rotterdam, in collaboration with the Public Health Services of the city of Eindhoven, the region of Geldrop-Valkenswaard, and the region of Helmond. The GLOBE study is supported financially by the Ministry of Welfare, Health and Cultural Affairs, the Sickness Fund Council ('Ziekenfondsraad'), the Netherlands Organization for Scientific Research ('NWO'), and Erasmus University Rotterdam.

1 Gove WR. Sex, marital status, and mortality. *American Journal of Sociology* 1973;**79**:45–67.
2 Carter H, Glick PC. Marital status and health. In: *Marriage and divorce: A social and economic study.* Cambridge, MA: Harvard University Press, 1976:324–357.
3 Verbrugge L. Marital status and health. *Journal of Marriage and the Family* 1979;**41**:267–85.
4 Morgan M. Marital status, health, illness and service use. *Soc Sci Med* 1980;**14A**:633–43.
5 Anson O. Marital status and women's health revisited: the importance of a proximate adult. *Journal of Marriage and the Family* 1989;**51**:185–94.
6 Rosengren A, Wedel H, Wilhelmsen L. Marital status and mortality in middle-aged Swedish men. *Am J Epidemiol* 1989;**129**:54–64.
7 Trovato F, Lauris G. Marital status and mortality in Canada: 1951-1981. *Journal of Marriage and the Family* 1989;**51**: 907–22.
8 Hu Y, Goldman N. Mortality differentials by marital status: an international comparison. *Demography* 1990;**27**:233–50.
9 Wyke S, Ford G. Competing explanations for associations between marital status and health. *Soc Sci Med* 1992;**34**: 523–32.
10 Joung IMA, Mheen H van de, Stronks K, Poppel FWA van, Mackenbach JP. Differences in self-reported morbidity by marital status and by living arrangement. *Int J Epidemiol* 1994;**23**:91–97.
11 Berkman LF, Syme SL. Social networks, host resistance and mortality: a nine-year follow-up study of Alameda County residents. *Am J Epidemiol* 1979;**109**:186–204.
12 House JS, Landis KR, Umberson D. Social relationships and health. *Science* 1988;**241**:540–5.
13 Umberson D. Family status and health behaviours: social control as a dimension of social integration. *J Health Soc Behav* 1987;**28**:306–19.
14 Umberson D. Gender, marital status and the social control of health behavior. *Soc Sci Med* 1992;**34**:907–17.
15 Belloc NB, Breslow L. Relationship of physical health status and health practices. *Prev Med* 1972;**1**:409–21.
16 Layne N, Whitehead PC. Employment, marital status and alcohol consumption of young Canadian men. *J Stud Alcohol* 1985;**46**:538–40.
17 Miller-Tutzauer C, Leonard KE, Windle M. Marriage and alcohol use: a longitudinal study of "maturing out". *J Stud Alcohol* 1991;**52**:434–40.
18 Wilsnack SC, Klassen AD, Schur BE, Wilsnack RW. Predicting onset and chronicity of women's problem drinking: a five-year longitudinal analysis. *Am J Public Health* 1991; **81**:305–17.
19 King AC, Taylor CB, Haskell WL. Smoking in older women. Is being female a 'risk factor' for continued cigarette use? *Arch Intern Med* 1990;**150**:1841–6.
20 Broman CL. Social relationships and health-related behavior. *J Behav Med* 1993;**16**:335–50.
21 Sobal J, Rauschenbach BS, Frongillo EA Jr. Marital status, fatness and obesity. *Soc Sci Med* 1992;**35**:915–23.
22 Davis MA, Neuhaus JM, Moritz DJ, Segal MR. Living arrangements and survival among middle-aged and older adults in the NHANES I epidemiologic follow-up study. *Am J Public Health* 1992;**82**:401–6.
23 Ben-Shlomo Y, Davey Smith G, Shipley M, Marmot MG. Magnitude and causes of mortality differences between married and unmarried men. *J Epidemiol Community Health* 1993;**47**:200–5.
24 Mackenbach JP, Mheen H van de, Stronks K. A prospective cohort study investigating the explanation of socio-economic inequalities in health in the Netherlands. *Soc Sci Med* 1993;**38**:299–308.
25 Tas RFJ. Minder scheidingen van tafel en bed. *Mndstat bevolk (CBS)* 1991;7:8.
26 Hosmer DW, Lemeshow S. *Applied logistic regression.* New York: John Wiley & Sons, 1989.
27 Maldonado G, Greenland S. Simulation study of confounder-selection strategies. *Am J Epidemiol* 1993;**138**: 923–36.
28 Goddard E. Drinking and health – an official survey of new information from British households. *J Epidemiol Community Health* 1994;**48**:106.
29 Petitti DB, Friedman GD, Kahn W. Accuracy of information on smoking habits provided on self-administered research questionnaires. *Am J Public Health* 1981;**71**:308–11.
30 Patrick DL, Cheadle A, Thompson DC, Diehr P, Koepsell T, Kinne S. The validity of self-reported smoking: a review and meta-analysis. *Am J Public Health* 1994;**84**:1086–93.
31 Kuskowska-Wolf A, Bergström R, Boström G. Relationship between questionnaire data and medical records of height, weight and body mass index. *Int J Obes* 1992;**16**:1–9.
32 Lichtenstein E. The smoking problem: a behavioral perspective. *J Consult Clin Psychol* 1982;**50**:804–19.
33 Coppotelli HC, Orleans CT. Partner support and other determinants of smoking cessation maintenance among women. *J Consult Clin Psychol* 1985;**53**:455–60.
34 Mermelstein R, Cohen S, Lichtenstein E, Baer JS, Kamarck T. Social support and smoking cessation and maintenance. *J Consult Clin Psychol* 1986;**54**:447–53.
35 Zimmerman RS, Connor C. Health promotion in context: the effects of significant others on health behavior change. *Health Educ Q* 1989;**16**:57–75.
36 Aro S. Stress, morbidity, and health related behaviour. A five-year follow-up study among metal industry employees. *Scand J Soc Med* 1981;**25**(Suppl):66–93.