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A LONGITUDINAL STUDY OF HEALTH SELECTION IN MARITAL TRANSITIONS

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Abstract—We examined whether differences in health were associated with different probabilities of marital transitions in a longitudinal study, using Cox proportional hazard analysis. Data on approximately 10,000 Dutch persons of the GLOBE study, aged 15–74 years, were used for this purpose. The study started in 1991 and study subjects have been followed for 4.5 years. Of the four marital transitions studied (marriage among never married and divorced persons, and divorce and bereavement among married persons), only divorce among married persons was associated with health status: married persons who reported four or more subjective health complaints or two or more chronic conditions were, respectively, 1.5 and two times more likely to become divorced during follow-up than persons without these health problems. Since hardly any other studies have examined the role of health selection in marital transition with longitudinal data, more research is required before firm conclusions can be drawn. It can be concluded, however, that the frequently made assumption that health selection contributes only little to the explanation of health differences between marital status groups, seems, at least for the divorced, not justified. © 1997 Elsevier Science Ltd. All rights reserved

Key words—marital status, health status, health selection

INTRODUCTION

Since the previous century many studies have shown marital status differences in mortality rates (Ben-Shlomo *et al.*, 1993; Farr, 1858; Gove, 1973; Koskenvuo *et al.*, 1979; Livi-Bacci, 1985; Mergenhagen *et al.*, 1985; Rogers, 1995; Sheps, 1961; Shurtleff, 1955; Trovato and Lauris, 1989) and morbidity rates (Anson, 1989; Carter and Glick, 1976; LaHorgue, 1960; Morgan, 1980; Verbrugge, 1979; Wyke and Ford, 1992). Results from these studies generally show that married persons have the lowest mortality and morbidity rates, divorced persons have the highest rates and never married and widowed persons have rates in between.

In contrast to the many descriptive studies, research of the explanation of the relationship between marital status and health has been more scarce, although there has been a growth of explanatory studies in the past two decades (Ben-Shlomo *et al.*, 1993; Goldman, 1993; Goldman *et al.*, 1995; Gove, 1973; Hu and Goldman, 1990; Kisker and Goldman, 1987; Kobrin and Hendershot, 1977; Livi-Bacci, 1985). There is general agreement that two processes could be responsible for the health differences between marital status groups: selection mechanisms and social causation mechanisms. According to the selection theory the relatively good health status of married persons is the result of the selection of "healthy" persons into and "unhealthy" persons out of the married state, thus increasing the relative amount of unhealthy persons in the unmarried states (Goldman, 1993; Livi-Bacci, 1985). In the literature on selection processes a distinction is made between direct and indirect selection (Goldman, 1993). In the case of direct selection health itself would be the selection criterion. In the case of indirect selection, determinants of health (factors associated with health and illness such as socio-economic status or alcohol consumption) would be selection criteria. According to the social causation theory marriage has a health promoting or a health protective effect while being unmarried would have adverse health effects (Gove, 1973; Kobrin and Hendershot, 1977; Verbrugge, 1979; Wyke and Ford, 1992). In the social causation theory the effect of marital status on health is generally assumed to be intermediated by psychosocial factors (i.e. psychosocial stress, social support), material circumstances (i.e. income, housing) and health behaviours (i.e. smoking, alcohol) (Booth and Amato, 1991; Gerstel *et al.*, 1985; Goldman *et al.*, 1995; Lillard and Waite, 1995; Rogers, 1995; Ross, 1995, Umberson, 1987, Wyke and Ford, 1992). The marital selection theory and social causation theory are not mutually exclusive and most researchers maintain that a combination of selection

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and causal factors can account for the health differences between marital status groups (Goldman *et al.*, 1995; Kisker and Goldman, 1987; Morgan, 1980; Wyke and Ford, 1992).

Several longitudinal studies have provided evidence that social causation mechanisms are operative in the association between marital status and health (Ben-Shlomo *et al.*, 1993; Ebrahim *et al.*, 1995; Goldman *et al.*, 1995; Jagger and Sutton, 1991; Schaefer *et al.*, 1995). Approaches to test the validity of the selection theory have mainly used aggregate patterns of mortality by marital status, derived from *cross-sectional data* (Hu and Goldman, 1990; Kisker and Goldman, 1987; Livi-Bacci, 1985; Sheps, 1961; Zalokar, 1960). However, as was convincingly demonstrated by Goldman *et al.* (Goldman, 1993, 1994; Goldman *et al.*, 1993), the outcomes of these cross-sectional studies cannot be used as support for the validity of the selection theory. Firstly, the hypotheses which were used to test the validity of the selection theory can be criticized. Secondly, since cross-sectional data were used, the outcomes would only be supportive of the selection theory at the expense of the importance of the social causation theory, if the hypotheses deducted from the selection theory would predict contrasting, or at least other, mortality patterns by marital status than hypotheses derived from the social causation theory. However, similar hypotheses can be derived from the selection theory and social causation theory. Therefore, longitudinal data are required to test whether selection mechanisms cause health differences between marital status groups (Goldman, 1993, 1994; Goldman *et al.*, 1993).

In this study longitudinal data are used to examine whether differences in health at baseline were associated with different probabilities of marital transitions in The Netherlands during a follow-up period of approximately 4.5 years. In the sociological and psychological literature many longitudinal studies of determinants of union formation and dissolution have been described (Karney and Bradbury, 1995; Waite and Spitze, 1981). In these studies, however, physical health has been disregarded as a determinant of marital formation and marital dissolution. For instance, in a recent paper (Karney and Bradbury, 1995) in which some 115 longitudinal studies of the determinants of marital quality and marital dissolution were reviewed, only one study addressed physical health (Booth and Johnson, 1994).

We examined whether direct selection effects (selection on health) could be demonstrated in four marital transitions: marriage among never married and divorced persons, and divorce and bereavement among married persons. Direct selection refers to the process through which health differences precede marital status, and is opposed to social causation, the process through which marital status affects health. Health selection could cause health differences by marital status in several ways. Health selection in partner choice is the most straightforward mechanism: unhealthy persons might be less attractive marriage partners and thus might either not be chosen, or, if illness develops during marriage, might be discarded as a marriage partner. Health selection might also operate through assortive mating. Assortive mating refers to the fact that persons generally tend to marry partners with resembling traits such as physical attractiveness (Murstein, 1972; Tambs and Moum, 1992). Assortive mating probably also includes health status (Collins and Coltrane, 1992). Assortive mating would not as much influence *whether* one marries as well *whom* one marries. If indeed the unhealthy are more likely to marry unhealthy others, one could find that unhealthy married persons are more likely to become widowed, since their unhealthy partner is at greater risk of mortality. Additionally, it is conceivable that relationships in which both partners are unhealthy are more stressful and therefore more prone to dissolution (Bloom *et al.*, 1978). Finally, with regard to the transition from the married to the widowed state, health selection might also operate through processes independent of health considerations at partner choice, but, for instance, through the identification of a group in which both spouses have developed health problems after marriage for reasons such as a joint unfavourable environment* (i.e. material circumstances or health behaviours). In this case health differences between the married and widowed are not caused by the conditions of widowhood itself (social causation), but are based in already existing health differences between those who will become widowed and those who will remain married (selection) (Kraus and Lilienfeld, 1959).

We tested whether existing health differences were associated with different probabilities of subsequent marital transitions. If health differences between marital status groups are at least in part the result of selection on health, health at one point in time is expected to predict the probability of changes in marital status later in time. We expected that never married and divorced person in good health would be more likely to marry than those in

*The 'joint unfavorable environment' might be the result of homogamy (the tendency of people to marry partners with similar socio-demographic backgrounds such as socioeconomic class), assortive mating (the fact that persons generally tend to marry partners with resembling traits such as health related behaviors) or might be more independent of the process of partner choice (e.g., living in a polluted area). When the 'joint unfavorable environment' already has caused illness in the surviving spouse at the moment of bereavement, this is considered direct selection. When risks of ill-health are increased but illness has not yet developed, this is considered indirect selection.

ill health, and that married persons in ill health would be more likely to divorce or become widowed than those in good health.

MATERIAL AND METHODS

Study population

We have used data of the GLOBE study, which is the Dutch acronym for "Health and Living Conditions of the Population of Eindhoven and surroundings". The GLOBE study is a prospective cohort study, which investigates the explanation of sociodemographic inequalities in health in The Netherlands. Eindhoven is an industrial city of approximately 195,000 inhabitants in the southeast of The Netherlands (the fifth largest city in The Netherlands). Design and objective of this study have been described in detail elsewhere (Mackenbach *et al.*, 1993). For the study a random sample of 27,079 non-institutionalized persons with the 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 persons older than 45 and persons in the lowest and highest socio-economic groups were overrepresented. The baseline measurement took place in March 1991. All selected persons were sent a postal questionnaire. The overall response rate was 70.1% (18,973 persons).

The subpopulation used in the study presented here, consists of all respondents living in Eindhoven at the time of the baseline measurement (n = 10,811). From the municipality of Eindhoven we received information on marital transitions, deaths and migrations from Eindhoven of the respondents for the period between March 1991 and August 1995 including the corresponding dates of occurrence. From the other municipalities in the study area (and other Dutch municipalities if respondents moved from the study area) we also gathered information on marital transitions. However, information on dates at which the marital transitions took place outside Eindhoven was not complete and was therefore not used in the analyses.

For each of the marital transitions the analyses have been restricted to the age ranges in which the marital transition under study was common. The analyses of marriage among never married persons have been restricted to persons in the 20–39 age range at baseline, the analyses of divorce among married persons and marriage among divorced persons to the 25–64 age range and the analyses on bereavement among married persons to the 45–74 age range. Marriage among widowed persons has not been studied because of the rare occurrence of this event in our study population (only six of the 699 widowed persons at baseline married during the follow-up).

Variables

Several health measures have been used to test whether health differences at one point in time were associated with differences in the likelihood of marital transitions later on: perceived general health, subjective health complaints and chronic conditions. The question regarding perceived general health was "How is your health in general?" For the analyses the answer categories were dichotomized in good ("very good", "good") and less than good ("fair", "sometimes good and sometimes bad", "bad"). The subjective health complaints consisted of 13 complaints, such as regularly upset stomach and often feeling tired. Respondents were divided in those with none, one to three, and four or more complaints. With regard to the chronic conditions the respondent was asked to check for each of 23 listed chronic conditions whether they had this condition or whether they had been under treatment or control for this condition during the previous year (e.g. chronic obstructive lung diseases, serious heart disease or heart attack). Distinguished were persons with none, one, and two or more chronic conditions.

In the analyses we have controlled for several sociodemographic variables for which associations with both marital status transitions and health status have been shown: age (coded as five year age groups), sex, educational level (primary school; low vocational and lower general secondary; intermediate vocational and higher general secondary; higher vocational and university), religious affiliation (roman catholic; other religion; not religious) and employment status (gainfully employed; unemployed; student or in military service). All variables have been coded as dummy variables.

Statistical analysis

Cox proportional hazard models (Kalbfleisch and Prentice, 1980) have been fitted using the COXREG procedure in SPSS (Norusis and SPSS, 1992) in order to estimate health related differences in the probability of marital transitions while controlling for the effects of other covariates. For each of the marital transitions and each health measure separate models have been fitted. In the models the healthy category was the reference category. The regression coefficients and standard errors have been used to calculate relative risks (RR) and 95% confidence intervals (CI). In all models we have controlled for age, sex, educational level, religious affiliation and employment status. Since unhealthy never married and divorced persons were hypothesized to have lower marriage probabilities, their RRs were expected to be smaller than 1.00. Since unhealthy married persons were hypothesized to have higher divorce and bereavement probabilities, their RRs were expected to be larger than 1.00.

Marital transitions indicate the legal change in marital status. Since the social causation processes which are assumed to be associated with marital status are not likely to occur from one day to the next simultaneous with the change in legal marital status, social causation processes might already have influenced health before the actual marital transition. If, with regard to the transition from the married to divorced state, the marital problems that caused the divorce already were present at the time of the baseline health measurement and already had resulted in a deterioration of health, we would find that ill health was associated with increased divorce probabilities. This could be interpreted as support for the marital selection theory, while, instead, causal processes were involved. Similarly, with regard to the transition from the married to the widowed state, severe illness of one of the spouses might be a source of physical and emotional strain in the other spouse. In order to diminish these problems supplementary analyses have been carried out in which the time between the health measurement and the start of the observation period is gradually increased. In the first model of divorce and bereavement among married persons all events which occurred during the follow-up have been included. In the second model the events which occurred in the first year following baseline measurement and in the third model those occurring in the first two years following baseline measurement have been excluded from the analyses. As the time between health measurement and start of the observation period increases, social causation effects on the measurement of baseline health are assumed to decrease.

With regard to marriage probabilities, never married and divorced persons who have a relationship with a partner at the time of the baseline measurement already might have experienced positive health effects from this relationship and might also be more likely to become married than unmarried persons without a partner. Relating the baseline measurement of health to marriage probabilities would show an increased likelihood of marriage among persons in good health. In order to diminish these problems, models of marriage among never married and divorced persons have been fitted without and with control for partner status at baseline (cohabiting; partner, but not cohabiting; no partner).

The adequacy of the proportional hazard assumption was examined by using a standard graphical method (Kalbfleisch and Prentice, 1980; Norusis and SPSS, 1992): for each marital transition the log minus log survival functions of the separate health categories were plotted against time. For all four marital transitions the differences between the plots of the health categories were nearly constant. Additionally, the proportional hazard assumption was tested by modelling health status as a time dependent variable: the effects of health status on marital transition were allowed to vary with the log of time since baseline measurement (Hess, 1995; Kalbfleisch and Prentice, 1980). The models in which the effect of health status was allowed to vary over time were not significantly better than models in which proportional hazards were assumed. Thus, both methods indicated that the assumption of proportional hazards was reasonable.

Persons have been followed until the occurrence of the event under study or censored at either the end of follow-up, date of death or date of migration from Eindhoven. In the analysis of divorce among married persons, respondents who became widowed during the follow-up period have been censored at the date of bereavement. Similarly, in the analyses of the bereavement among married people, respondents who became divorced have been censored at the date of divorce. Table 1 shows for each of the marital transitions the number of the population at risk, the number of events and persons censored by cause of censoring.

RESULTS

Transition from never married to married

Table 2 shows for "healthy" and "less healthy" never married persons their RRs on marriage. None of the health measures showed a statistically significant association with marriage probability. Also, no support whatsoever was found for the selection hypothesis in the pattern of the RRs. The addition of partner status to the model hardly changed the RRs of "healthy" and "unhealthy" never married persons. The RRs for the control variables in the model containing partner status and chronic conditions are shown in the Appendix A. Most control variables were significantly related to marriage probability. Particularly employment status and partner status were important predictors of subsequent marriage among never married persons. Gainfully employed persons were most likely and students and persons in military service were least likely to marry. Persons who already lived with a partner were most likely and persons without a partner were least likely to marry.

Transition from divorced to married

None of the health measures showed a statistically significant association with marriage probability among divorced persons (Table 3). Also, no support whatsoever was found for the selection hypothesis in the pattern of the RRs. For instance the RRs of chronic conditions rather seemed to point to larger marriage probabilities of "unhealthy" than of "healthy" divorced persons. Addition of partner status to the model did not cause any major changes in the estimates of the RRs. The RRs for the control variables in the model containing part-

Table 1. Study subjects by marital status at baseline, number of events and the number of persons censored by cause of censoring

(Age range)	Transition: Never married → married (20–39)	Divorced → married (25–64)	Married → divorced (25–64)	Married → widowed (≥45)
Total population at risk	1601	701	5349	5047
Events	296	84	144	272
Censured cases:				
End of follow-up	846	539	4704	4323
Other marital transition	0	0	145	63
Death	1	22	111	247
Emigration	29	4	31	18
Migration	429	52	214	124
(Number of events among the migrated)	(15)	(4)	(1)	(0)

ner status and chronic conditions are shown in the Appendix A. Marriage among divorced persons decreased with age, was larger among men than women and was largest among persons who lived with a partner.

Transition from married to divorced

Differences in subjective health complaints and chronic conditions were significantly related to divorce probability (Table 4): the larger the number of subjective health complaints and chronic conditions the larger the likelihood of divorce. These associations remained largely unchanged after exclusion of divorces which occurred in the first and first two years following baseline measurement. Married persons with four or more subjective health complaints were 1.5 times more likely to become divorced than persons with less complaints. Married persons with two or more chronic conditions were two times more likely to become divorced than persons with less chronic conditions. Of the control variables only age was significantly related to divorce probability, while the association between employment status and divorce probability was borderline significant (see Appendix A).

Transition from married to widowed

None of the health measures showed a statistically significant association with bereavement probability (Table 5). Of the control variables age, sex and religious affiliation were significantly related to probability of widowhood (see Appendix A). Not surprisingly bereavement was higher among women than men and increased with age.

DISCUSSION

We examined whether differences in health were associated with different probabilities of marital transition during a period of approximately 4.5 years after baseline health measurement. Of the four marital transitions studied, only divorce among married persons was associated with health status at baseline: married persons who reported four or more subjective health complaints or two or more chronic conditions were, respectively, 1.5 and two times more likely to become divorced during follow-up than persons without these health problems. Additional control for possible social causation processes by excluding from the analyses divorces which occurred in the first two years after the baseline health measurement did not alter these results.

Table 2. Health related differences in the probability of marriage among never married persons[a]

	Without control for partner status RR	(95% CI)	With control for partner status RR	(95% CI)
Perceived general health				
Good	1.00		1.00	
Less	0.97	(0.67–1.38)	1.13	(0.79–1.63)
Subjective health complaints				
0	1.00		1.00	
1–3	1.09	(0.82–1.45)	1.13	(0.85–1.51)
≥4	0.94	(0.68–1.30)	0.90	(0.64–1.24)
Chronic conditions				
0	1.00		1.00	
1	1.12	(0.85–1.48)	1.17	(0.88–1.56)
≥2	1.22	(0.82–1.80)	1.21	(0.82–1.79)

[a]Separate models were fitted for each of the health measures; in each model age, sex, educational level, religion and employment status have been controlled for.
†$P < 0.10$, *$P < 0.05$, **$P < 0.01$.

Table 3. Health related differences in the probability of marriage among divorced persons[a]

	Without control for partner status		With control for partner status	
	RR	(95% CI)	RR	(95% CI)
Perceived general health				
Good	1.00		1.00	
Less	0.99	(0.61–1.61)	1.07	(0.65–1.74)
Subjective health complaints				
0	1.00		1.00	
1–3	1.10	(0.54–2.23)	0.99	(0.49–2.01)
≥4	1.11	(0.55–2.21)	1.10	(0.55–2.18)
Chronic conditions				
0	1.00		1.00	
1	1.20	(0.69–2.10)	1.27	(0.73–2.21)
≥2	1.41	(0.80–2.49)	1.53	(0.87–2.70)

[a]Separate models were fitted for each of the health measures; in each model age, sex, educational level, religion and employment status have been controlled for.
†$P < 0.10$, *$P < 0.05$, **$P < 0.01$.

Table 4. Health related differences in the probability of divorce among married persons[a]

	Divorces in years 0–4		Divorces in years 1–4		Divorces in years 2–4	
	RR	(95% CI)	RR	(95% CI)	RR	(95% CI)
Perceived general health						
Good	1.00		1.00		1.00	
Less	1.39	(0.95–2.05)	1.06	(0.67–1.69)	1.24	(0.71–2.14)
Subjective health complaints	*					
0	1.00		1.00		1.00	
1–3	0.92	(0.58–1.47)	0.92	(0.55–1.54)	1.10	(0.57–2.15)
≥4	1.52	(0.96–2.41)	1.26	(0.75–2.12)	1.59	(0.81–3.11)
Chronic conditions	**		*		**	
0	1.00		1.00		1.00	
1	1.17	(0.77–1.76)	0.95	(0.59–1.55)	0.98	(0.52–1.81)
≥2	2.04	(1.35–3.08)	1.94	(1.22–3.09)	2.35	(1.34–4.12)

[a]Separate models were fitted for each of the health measures; in each model age, sex, educational level, religion and employment status have been controlled for.
†$P < 0.10$, *$P < 0.05$, **$P < 0.01$.

In the interpretation of the results several issues regarding our data collection and data analysis need to be considered. First of all, the data on health status and the control variables are self-reported. This could have biased the results if there would have been systematic differences in the answering of the questions by marital status. With regard to this issue it is important to make a distinction between "illness" (subjective interpretation of the person involved) and "disease" (clinically diagnosed) (König-Zahn *et al.*, 1993). Since our data on health status are self-reported they should primarily be considered measures of subjective health ("illness"). It probably would have been preferable to examine both subjective and objective health measures. In decisions concerning marital transitions generally a second person is involved. If health status of the respondent is an issue in marital transitions, this second person will make his/her own evaluation of the respondent's health status. It is possible that this second person considers both information about the respondent's objective and subjective health status. However, little (or nothing) is known on this subject. It is possible that (more) effects of health selection could have been demonstrated if objective health measures had been used. This needs further research.

With regard to the data analysis, a source of bias could have been introduced in our study by the censoring of persons at the time they migrated from the city of Eindhoven. These persons were censored at the date of migration, because, although marital transitions itself were generally known, most dates of marital transition were unknown*. To examine the potential effects of censoring persons at the point they migrated from Eindhoven, a sensitivity analysis was carried out. In this analysis models were fitted in which persons who migrated were not censured at their date of migration, but instead at the end of follow-up (migrants who did not experience a marital transition) or were assumed to have

*The number of events among the persons who migrated from Eindhoven might raise some questions. Especially the number of marriages among never married persons who migrated from Eindhoven seems small relative to the total number of never married persons who migrated. Examination of the data, however, revealed large differences in employment status between the never married persons (at base-line) who did and did not migrate from Eindhoven: while approximately 20% of those who did not migrate was student or in military service (the category least likely to become married), this percentage was 40 among those who did migrate. The expected number of marriages among never married persons who migrated taking employment status into account was no more than 30.

Table 5. Health related differences in the probability of widowhood among married persons[a]

	Bereavement in years 0–4		Bereavement in years 1–4		Bereavement in years 2–4	
	RR	(95% CI)	RR	(95% CI)	RR	(95% CI)
Perceived general health						
Good	1.00		1.00		1.00	
Less	0.82	(0.49–1.38)	1.19	(0.88–1.61)	1.22	(0.86–1.75)
Subjective health complaints						
0	1.00		1.00		1.00	
1–3	1.20	(0.83–1.73)	1.27	(0.83–1.95)	1.28	(0.78–2.12)
≥4	1.08	(0.74–1.57)	1.17	(0.76–2.12)	1.21	(0.72–2.04)
Chronic conditions						
0	1.00		1.00		1.00	
1	1.06	(0.78–1.44)	1.08	(0.76–1.54)	1.29	(0.86–1.93)
≥2	0.95	(0.69–1.30)	0.96	(0.67–1.37)	0.98	(0.64–1.51)

[a]Separate models were fitted for each of the health measures; in each model age, sex, educational level, religion and employment status have been controlled for.
†$P < 0.10$, *$P < 0.05$, **$P < 0.01$.

experienced an event at an estimated date (migrants who did experience a marital transition; the marital transition was assumed to have occurred in the middle of the period between migration from Eindhoven and the date we received information on the marital transition). The results of these analyses were virtually identical to those reported above (results not shown).

In the analyses three rather broad categories of educational level were distinguished. Since educational level is associated with both the likelihood of marital transitions and the presence of ill health, the adjustment for educational level might still have resulted in residual confounding. In our dataset seven categories of educational level could be distinguished. Analyses have been performed with the three broad categories, since analyses with the seven educational levels could not be performed in the smallest study group (studying transition from divorced to married). For the other marital transitions, the estimated relative risks from models in which there was adjustment for seven educational levels (data not shown) hardly differed from those with adjustment for the three educational levels. We therefore believe that there is no residual confounding by educational level after adjustment for the variable in which three broad educational levels are distinguished.

Finally, men and women have been analysed simultaneously, while controlling for sex. This would have obscured selection effects if the association between health differences and subsequent marital transition would have been opposite for men and women. In order to examine this possibility, we tested whether there was statistically significant interaction between sex and health status (results not shown). This proved not to be the case. Additionally, analyses of the transition from married to divorced in which separate models were estimated for men and women, indicated that selection effects might be larger among men than among women. The RRs of married people with two or more chronic conditions with regard to the likelihood of divorce were 2.53 (CI 1.37–4.68) and 1.64 (CI 0.93–2.91) for men and women, respectively.

Several earlier studies have presented indirect indications that health selection might be relevant in marital transitions. For instance, Helsing *et al.* (1981) found that the advantage in mortality rate of widowers who remarried compared to those who did not remarry was larger in the first three years than in later years of remarriage. This might indicate that unhealthy widowers with high probabilities of dying in the short term were not selected for remarriage. Ben-Shlomo *et al.* (1993) found that the elevated mortality risks of never married men in comparison with married men disappeared after adjustment for baseline health.

To our knowledge three studies have examined health selection in marital transitions more directly. In all these studies some evidence is found for health selection, however there are inconsistencies within and between the studies. Mastekaasa (1992) studied whether health differences in never married persons in Norway (aged 20–39 years) affected marriage probabilities. Mastekaasa found that having a disease reduced the probability of marriage among never married men ($n = 6431$), but not of never married women ($n = 3252$). Limiting our analyses to never married men and distinguishing only two health categories, those without and those with at least one chronic conditions, we did not find statistically significant differences in marriage likelihood, nor did the size of the RRs point to lower marriage probabilities of the "unhealthy" (data not shown). Cultural differences between Norway and The Netherlands might be involved. More research with other data sets is required to reproduce either of these findings and to determine the role of cultural differences. Waldron *et al.* (1996) found that health problems (measured as a health status scale based on questions on disabilities and subjective health complaints) were negatively correlated with the likelihood of being married at follow-up among women aged 25–34 years at baseline ($n = 3395$). Since marital status was measured as a dichoto-

mous variable, married versus not married, this could either mean that healthy people are more likely to become married, that unhealthy people are more likely to experience a marital breakup, or both. The correlation between health and the likelihood of marriage was only present in the first of two periods which were studied (in 1978–1983, but not in 1983–1988). Since the different marital transitions were not studied separately it is difficult to compare the outcomes of Waldron *et al.*'s study with our study. Lillard and Panis (1996) found evidence of adverse selection into marriage in a male study population (n = 4000) in which health was measured as perceived general health. They found that healthier men were less likely to (re)marry: healthier men married later and postponed remarriage. In our study, the RRs for chronic conditions with regard to the likelihood of marriage among the never married (Table 2) and the divorced (Table 3) pointed in the direction of adverse selection, but were not statistically significant. The comparable RRs for perceived general health did not indicate any form of health selection. Thus, these studies all provide some evidence that health selection is operative in marital selections. However, the evidence is partial: sometimes only one marital transition is studied, or marital status is dichotomized as married versus unmarried, or only a single health measure is used. These imperfections are improved by means of this study. There remain, however, inconsistencies within and between studies, which cannot be solved with the outcomes of our study. More longitudinal studies are required to clarify these inconsistencies.

In order to diminish potential social causation effects in the analyses of divorce among married persons, supplementary analyses were carried out in which the time between the health measurement and the start of the observation period was gradually increased up to two years. Is this period sufficient to exclude potential social causation effects? Divorce is a legal condition which has to be brought before the court of law. The procedure at the court takes on average one to two months when there is mutual consent among the spouses and six to 12 months in more complicated cases. Thus, the period of two years seems reasonable with regard to the duration of the legal procedure. However, decisions concerning divorce are probably not taken from one day to the next and the duration of the decision process might show large variations between individuals. However, the fact that RRs of divorce did hardly decrease if time between health measurement and the start of the observation period was increased supports the assumption that the differences in RR are due to health selection. In order to further control for potential social causation effects, the analyses were repeated with simultaneous control for all three health measures in one model. We assume that marital problems will affect perceived general health and subjective health complaints to a larger extent than the chronic conditions. If differences in chronic conditions still are related to divorce probabilities after adjustment for perceived general health and subjective health complaints, this strongly suggests that health selection is operative. The RRs of divorce among married persons with two or more chronic conditions after adjustment for perceived general health and subjective health complaints were 1.97 (CI 1.22–3.17; divorces in years 0–4), 2.13 (CI 1.24–3.64; divorces in years 1–4) and 2.39 (CI 1.25–4.56; divorces in years 2–4)*. We feel that our study demonstrates convincingly that health selection is operative in the transition from the married to the divorced state.

Our findings suggested that selection on health did not occur with regard to marriage among never married and divorced persons and bereavement among married persons. On the one hand, this seems implausible, since one would expect that if health selection indeed occurs in one marital transition, health selection also plays a part in other marital transitions. On the other hand, it is conceivable that processes involved in the different marital transitions are not quite the same. Healthy and unhealthy unmarried persons seem to have equal marriage chances, but once married unhealthy persons appear to have larger divorce chances. This could mean that health is not considered important in initial partner choice, but that ill health of one of the partners might prove to be a burden for maintaining the relationship. Or this could mean that assortive mating is at work: "healthy" and "unhealthy" unmarried persons have comparable marriage probabilities, but the "healthy" are more likely to marry "healthy" others, while the "unhealthy" are more likely to marry "unhealthy" others. Subsequent changes in health status among the healthy couples, however, might be relevant for marital dissolution. Discrepancies in health status which arise in an initially healthy couple, might cause, or contribute to, marital dissolution. These hypotheses need further research in which preferably information on health status of both marriage partners should be available and in which effects of health (changes) on marital quality is addressed. In any case, the finding that health selection only plays a role in the transition from the married to the divorced state is not as implausible as it might seem at first sight. Additionally, this finding might partially explain why generally higher excess morbidity is found among divorced people than among never married and widowed people.

In this study only selection on health was examined. In the literature a distinction is made between direct (selection on health) and indirect selection

*The overall statistical significance of adding chronic conditions to the model was < 0.05 in all three models.

(Goldman, 1993). In the case of indirect selection, determinants of health (factors associated with health and illness) are assumed to be the selection criteria, such as socio-economic status, physical appearance (e.g. body height, obesity), health related habits (e.g. alcohol consumption) and emotional stability (Goldman, 1993). Evidence from a number of studies suggests that marital transition probabilities indeed differ by some of these health related characteristics (Carter and Glick, 1976; Collins and Coltrane, 1992; Fu and Goldman, 1996; Kiernan, 1988; Macintyre, 1986). Especially in young age groups where the prevalence of health problems is rather small, it is conceivable that indirect selection is more important than direct selection. Some support for this assumption can be found in the fact that among the never married many statistically significant associations were found between the control variables and the probability of marriage but not for the health measures (see Appendix A). The fact that no direct selection could be demonstrated for most of the marital transitions studied should therefore not be interpreted as evidence of absence of selection in these transitions. Indirect selection processes might be present and need further research.

The detection of differences in divorce probabilities between "healthy" and "unhealthy" married persons, raises the question to what extent health selection can account for health differences between married and divorced persons. It has generally been assumed that health selection in marital transition might explain some of the health differences found between marital status groups, but the selection effects would be small or negligible compared to social causation effects. To estimate the relative importance of selection and social causation mechanisms, information on health status at different points in time is required between which part of the population has experienced a marital transition. In this way the size of health differences between marital status groups caused by health selection can be determined and related to the size of the health differences observed at one point in time, which result from both selection and social causation mechanisms. Unfortunately, no data on health status at the end of the follow-up period were available. In order to still obtain some idea of the importance of selection effects for the explanation of health differences between marital status groups, two logistic regression models were fitted. In the first model, health differences at baseline between those who would remain married (reference category) and those who would become divorced during the follow-up period were estimated, while adjusting for age, sex, educational level, religious affiliation and employment status. The health measures were dichotomized in "good" versus "less than good" perceived general health, less than four versus four or more subjective health complaints and less than two versus two or more chronic conditions. The odds ratios of those who would become divorced compared to those who would remain married with 95% CI were 1.39 (0.94–2.06), 1.58 (1.11–2.24) and 1.92 (1.29–2.84), respectively, for these health measures. The odds ratios from model 1 illustrate the size of the health differences between married and divorced people, which might be expected solely on the basis of selection effects. In the second model, health differences were estimated between those married at baseline (reference category) and those divorced at baseline, while adjusting for the same variables. The odds ratios of those divorced at baseline compared to those married at baseline with 95% CI were 2.08 (1.73–2.48), 1,73 (1.45–1.75) and 1.45 (1.19–1.75), respectively, for these health measures. The odds ratios of the second model illustrate the size of cross-sectional health differences (resulting from both selection and social causation effects) between married and divorced people in our baseline study population. Since it can not be assumed that the health differences at the end of the observation time between those who have remained married and those who became divorced during the observation time will be exactly the same as those between the married and divorced at baseline, the odds ratios of both models can not be related to each other directly. It is, however, likely that the size of the health differences between those who remained married and those who became divorced will show a resemblance to the differences between the married and divorced at baseline. The comparison of the odds ratios from model 1 with the odds ratios of model 2, indicates that selection effects might be able to account for a considerable part of the cross-sectional differences in perceived general health: i.e. in the study population direct selection might result in an OR of about 1.40 of divorced versus married people; previous cross-sectional differences in ORs between divorced and married people in the same base population were about two. Following a similar reasoning our results show that selection effects might account for the majority of differences in subjective health differences and all differences in chronic conditions between married and divorced people. Our data do not allow us to determine the relative contribution of selection effects to the explanation of health differences by marital status. Our results do indicate, however, that health selection might be much more important in the explanation of health differences by marital status than is generally assumed.

In summary, large and highly significant differences in divorce probabilities were demonstrated between "healthy" and "unhealthy" married persons. The differences in chronic conditions still existed after additional control for possible social causation effects, i.e. exclusion of divorces which occurred in the first two years after baseline

measurement and after adjustment for perceived general health and subjective health complaints. We conclude that our study demonstrated convincingly that health selection is operative in the transition from the married to the divorced state. Additionally, our findings further suggest that the frequently made assumption that health selection contributes only little to the explanation of health differences between marital status groups, seems, at least for the divorced, not justified. More research is required before firm conclusions regarding the presence of health selection in the other marital transitions can be drawn and the relative contribution of selection and social causation processed to health differences between marital status groups can be assessed. The issue of indirect selection in marital transitions also needs further research.

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APPENDIX A

Table A1. Differences in the probability of marital transition by the control variables for the marital transition models containing chronic conditions

	Marriage chances among never married persons (with control for partner status) RR	Marriage chances among divorced persons (with control for partner status) RR	Divorce chances among married persons (divorce in years 0–4) RR	Widowhood chances among married persons (bereavement in years 0–4) RR
Age	*	*	**	**
20–24	1.00			
25–29	0.97	1.00	1.00	
30–34	0.82	1.48	0.95	
35–39	0.39	0.74	0.72	
40–44		0.57	0.46	
45–49		0.34	0.23	1.00
50–54		0.47	0.24	1.62
55–59		0.43	0.17	1.64
60–64		0.25	0.09	4.72
65–69				6.66
70–74				9.00
Sex		**		**
Male	1.00	1.00	1.00	1.00
Female	1.14	0.51	0.73	2.65
Educational level	*			
High	1.00	1.00	1.00	1.00
Medium	1.29	0.85	1.31	1.39
Low	0.88	0.97	1.19	1.55
Religion	*			*
Roman catholic	1.00	1.00	1.00	1.00
Other	1.40	1.78	1.25	0.98
Non	0.85	1.20	0.99	1.64
Employment status	**		†	
Gainfully employed	1.00	1.00	1.00	1.00
Unemployed	0.62	1.15	1.50	0.98
Student/military service	0.23	—	—	—
Partner status	**	**		
Cohabiting	1.00	1.00		
Partner, not cohabiting	0.46	0.37		
No partner	0.19	0.39		
Chronic conditions			**	
0	1.00	1.00	1.00	1.00
1	1.17	1.27	1.17	1.06
⩾2	1.21	1.53	2.04	0.95

†$P < 0.10$, *$P < 0.05$, **$P < 0.01$.