Positively and negatively experienced social support and long-term mortality among middle-aged Dutch people


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This study investigated the relation between positive and negative experiences of social support and mortality in a population-based sample. Data were derived from Dutch men and women aged 20–59 years who participated in the Doetinchem Cohort Study in 1987–1991. Social support was measured at baseline and after 5 years of follow-up by using the Social Experiences Checklist indicating positive (n = 11,163) and negative (n = 11,161) experiences of support. Mortality data were obtained from 1987 until 2008. Cox proportional hazards regression models, adjusted for age and sex, showed that low positive experiences of support at baseline were associated with an increased mortality risk after, on average, 19 years of follow-up (hazard ratio = 1.26, 95% confidence interval: 1.04, 1.52). Even after additional adjustment for socioeconomic factors, lifestyle factors, and indicators of health status, the increased mortality risk remained statistically significant (hazard ratio = 1.23, 95% confidence interval: 1.01, 1.49). For participants with repeated measurements of social support at 5-year intervals, a stable low level of positive experiences of social support was associated with a stronger increase in age- and sex-adjusted mortality risk (hazard ratio = 1.57, 95% confidence interval: 1.03, 2.39). Negative experiences of social support were not related to mortality.

Materials and methods

Study design

The Doetinchem Cohort Study is a prospective cohort study set up to investigate the impact of lifestyle factors...
and biologic risk factors on health (20). The first examination round (1987–1991) comprised 12,448 men and women aged 20–59 years who lived in Doetinchem, a town in the eastern Netherlands. Two-thirds of those who were measured in round 1 were randomly selected after 5 years (between 1993 and 1997) for the first follow-up measurements. Until now, 3 follow-up rounds of the Doetinchem Cohort Study have been completed. All participants were asked to fill out a questionnaire at home about lifestyle and diseases. Thereafter, the participants were invited to return the questionnaire to the community health service, where it was checked by a trained research assistant for completeness and consistency and where measurements of biologic factors were collected. The overall response rates were 62% for the baseline measurement and 79% (n = 6,114) for the first follow-up measurement 5 years later.

Mortality

Vital status was obtained through the municipal population registries. It was complete up to November 2008.

Experiences of social support

Experiences of social support were assessed by the Social Experiences Checklist at baseline and after 5 years of follow-up (21, 22). The checklist was initially developed to study the quality of life of cancer patients. However, van Oostrom et al. (21) showed that the checklist could also be used in a general population by demonstrating that its psychometric qualities were similar in both populations. The Social Experiences Checklist reflects experiences in social relationships and consists of 16 items: 8 items correspond to positive experiences of social support, such as warmth and friendliness, esteem, and help; and 8 items correspond to negative experiences, such as incomprehension, belittlement, and avoidance. Responses to these questions are formulated on a Likert-type scale, indicating “never,” “sometimes,” “regularly,” or “often.”

Levels of positive and negative experiences of social support at baseline were determined by creating tertiles of the sum scores. To assess levels of social support over time, participants were classified into 5 groups: 1) stable high levels of experienced social support, when scoring in the highest tertile in both replicate measurements; 2) stable medium level of support, when scoring in the mid-tertile in both measurements; 3) stable low level of support, when scoring in the lowest tertile in both measurements; 4) increasing levels of support, when scoring in a higher tertile at the follow-up measurement compared with the baseline measurement; and 5) decreasing levels of support, when scoring in a lower tertile at the follow-up measurement compared with the baseline measurement.

Socioeconomic conditions

Ethnicity was dichotomized into Dutch or non-Dutch. Marital status was categorized into married or unmarried. Education was based on the highest level of education completed by respondents and was divided into 3 categories: low (primary school, lower vocational education or less), medium (medium vocational education, high school), and high (higher vocational education, university). Employment status was dichotomized into currently employed or currently unemployed.

Health behaviors

Lifestyle variables included smoking behavior (current smoker, former smoker, never smoker), alcohol consumption (frequency and number of alcoholic drinks), and physical activity (perceived frequency and intensity of activities). Alcohol consumption was calculated as average drinks per day and was categorized into 0–1 or 2 or more. Physical activity was assessed with a single question on physical activity during leisure time. Participants who reported no or little physical activity were classified as inactive, and those who reported themselves to be active regularly were classified as active.

Health status

Health status included biomedical measures, self-reported chronic diseases, and self-perceived health. Weight and height were measured to the nearest 0.1 kg and 0.5 cm, respectively. The respondents were weighed wearing indoor clothing after they had removed their shoes and emptied their pockets. Accordingly, 1 kg was subtracted from their weight to take clothing into account. Body mass index was calculated by using measured height and weight (kg/m^2); respondents were allocated to one of the following categories: normal weight (<25 kg/m^2), overweight (25–29.9 kg/m^2), and obese (≥30 kg/m^2) (23). Blood pressure was measured twice, with participants in a seated position, by using a random zero sphygmomanometer according to a standardized procedure. Hypertension was defined as a mean systolic blood pressure of ≥140 mm Hg and/or a diastolic blood pressure of ≥90 mm Hg and/or use of antihypertensive drugs (24). Cholesterol values were determined in nonfasting blood plasma, which was stored at −20°C for a maximum of 3 weeks. Hypercholesterolemia was defined as a total cholesterol level of ≥6.5 mmol/L. The presence of chronic diseases was measured by asking the participants whether they had diabetes, cardiovascular disease, or cancer. Self-perceived health was ascertained by asking, How would you rate your health in general?, using a 5-point scale ranging from excellent to poor. Good self-perceived health was defined as having good or excellent health.

Statistical analyses

According to the first analytical strategy, we investigated the relation between a single measurement of social support at baseline and mortality after 20 years of follow-up. In this analysis, 90% of the baseline participants in the Doetinchem Cohort Study had complete data on the positive items (n = 11,163) or on the negative items (n = 11,161) of the Social Experiences Checklist. We also analyzed the relation between social support and mortality among participants with follow-up measurements, according to the second strategy.
In this group of 6,114 participants, 86% had complete data on the Social Experiences Checklist at baseline and after 5 years. The additional analysis enabled us to ascertain the association between stable levels of social support and subsequent mortality with less measurement error.

Survival analyses were used to investigate the relation between social support and subsequent mortality using both analytical strategies. We used the Cox proportional hazards model to calculate hazard ratios with 95% confidence intervals for the relation between experiences of social support and mortality, with the most favorable tertile of support as the reference group. We adjusted for baseline age and sex (model 1), socioeconomic factors (model 2), health behaviors (model 3), and health status (model 4) to explore their roles as potential confounders. Ethnicity was not included in the model since only 1.5% of the participants were of non-Dutch origin. Sex was considered as an effect modifier, but the interaction terms with positive and negative experiences of social support were not statistically significant ($P < 0.05$). All statistical analyses were carried out by using version 9.1 of the SAS software program (SAS Institute, Inc., Cary, North Carolina).

**RESULTS**

From 1987 to 2008, approximately 7.2% of the eligible participants died after an average of 18.7 years of follow-up. The general characteristics of the participants according to levels of social support are described in Table 1. The mean age of the study population at baseline was 39.1 years (standard deviation, 10.7), and 47% were male. For both positive and negative experiences of support, the proportion of unmarried people increased with increasing tertiles of social support. Opposite patterns for positive and negative experiences of support were observed with regard to educational level. A high educational level was more prevalent among the participants who experienced high levels of positive support (19%). Correspondingly, higher levels of negative support were associated with a lower educational level (63%). Most of the participants were in good health (76%) and adhered to a healthy lifestyle characterized by non-smoking (62%), no or moderate drinking (81%), and sufficient physical activity (67%).

Table 2 shows hazard ratios and 95% confidence intervals for all-cause mortality according to tertiles of social support experienced by the population at baseline. The hazard ratio was 1.26 (95% confidence interval: 1.04, 1.52) for those with low levels of positive experiences of social support compared with those with the highest level of social support. Adjustment for socioeconomic factors, health behaviors (smoking, alcohol consumption, and physical activity), and indicators of health status slightly attenuated the results (hazard ratio = 1.23, 95% confidence interval: 1.01, 1.49). Negative experiences of social support were not associated with mortality. Compared with those for the lowest tertile of social support, the age- and sex-adjusted hazard ratios were 1.01 (95% confidence interval: 0.85, 1.20) for the mid-tertile and 1.04 (95% confidence interval: 0.87, 1.25) for the highest tertile.

Analyses in the follow-up group with repeated measurements of social support showed that participants who had stable low levels of positive social support over a 5-year period had a stronger increase in mortality risk (hazard ratio = 1.57, 95% confidence interval: 1.03, 2.39) (Table 3). This association was attenuated after adjustments for socioeconomic and lifestyle factors and for health status (hazard ratio = 1.42, 95% confidence interval: 0.92, 2.19). Again, negative experiences of social support were not related to mortality.

**DISCUSSION**

This study of Dutch men and women showed that low levels of positive experiences of social support were related to an increased probability of mortality after a long-term period. Using repeated measurements of social support to determine stable high levels of support yielded stronger associations for positive experiences of social support with mortality. Adjustment for socioeconomic and lifestyle factors and for indicators of health status did not attenuate the original associations considerably, indicating a direct effect of positive experiences of social support on mortality. Negative experiences of social support, however, were not related to mortality in this study.

The primary strength of the present study was that 2 analytical strategies were utilized to overcome the problem of measurement error and longer-term fluctuations or changes within individuals. We accounted for the possibility that measuring social support only once at baseline might not be a reliable indicator of “usual” level of social support (25, 26). By following a second strategy—analyzing stable levels of social support over 5 years among participants with repeated measurements—we were able to limit this possible regression dilution bias. Indeed, stable low levels of positive experiences of social support were more strongly associated with increased mortality. To support the suggestion that measurement error or changes within individuals accounted for the attenuation of the associations in the baseline sample, we found a test-retest correlation coefficient of 0.49 for positive as well as for negative experiences of support between the 2 measurements, which indicates that a single measurement is a moderate indicator for long-term social support.

Moreover, there were some differences between the 2 analytical strategies according to follow-up time, population, and classification of exposure. Differences in follow-up time from the time of the social support measurements might have influenced the associations in this study; the follow-up time for mortality in the group with repeated measurements of social support was, on average, 5 years shorter than in the baseline population. On the basis of the survival curves, the difference in survival between the tertiles of social support accumulated over time (results not shown). Consequently, we might have expected even more profound results with increasing follow-up time. Another factor that could have influenced our findings was possible selection bias due to follow-up. The response rate for the follow-up measurement was 79%, which is quite reasonable.
However, the mortality rate in the population at baseline (7.2%) was somewhat higher than that in the follow-up population (5.5%), which might indicate that the unhealthy participants at baseline were more likely to drop out of the study. Excluding the first 2 years of follow-up did not affect the results, which underscores the predictive effect of social support at baseline and rules out the possibility of reverse causation (results not shown).

Using repeated measurements for which participants were classified as having stable high positive or negative experiences of social support when scoring in the highest tertile at both measurements might reflect more extreme groups of exposure. However, the median scores of the tertiles when the single measurement of social support was used did not differ from the median scores of the tertiles when both measurements were used. Following
all the findings we discussed above, we assumed that the difference in results between the 2 analytical strategies we used might be caused by regression dilution bias rather than by differences in follow-up time, selection of study population, reverse causation, or classification of exposure.

Table 2. Hazard Ratios of Mortality by Tertile of Baseline Level of Positive and Negative Experiences of Social Support, Doetinchem Cohort Study, the Netherlands, 1987–1991

<table>
<thead>
<tr>
<th></th>
<th>No. of Participants</th>
<th>No. of Deaths</th>
<th>%</th>
<th>Model 1a (n = 11,163)</th>
<th>Model 2b (n = 11,136)</th>
<th>Model 3c (n = 11,101)</th>
<th>Model 4d (n = 10,989)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>HR 95% CI</td>
<td>HR 95% CI</td>
<td>HR 95% CI</td>
<td>HR 95% CI</td>
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<tr>
<td>Positive experiences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertile 3 (high)</td>
<td>3,179</td>
<td>170</td>
<td>5.3</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Tertile 2</td>
<td>4,686</td>
<td>330</td>
<td>7.0</td>
<td>1.06</td>
<td>0.88, 1.28</td>
<td>1.07</td>
<td>0.89, 1.29</td>
</tr>
<tr>
<td>Tertile 1 (low)</td>
<td>3,298</td>
<td>306</td>
<td>9.3</td>
<td>1.26</td>
<td>1.04, 1.52</td>
<td>1.23</td>
<td>1.02, 1.49</td>
</tr>
<tr>
<td>Negative experiences</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Tertile 1 (low)</td>
<td>2,982</td>
<td>217</td>
<td>7.3</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>Tertile 2</td>
<td>4,465</td>
<td>310</td>
<td>6.9</td>
<td>1.01</td>
<td>0.85, 1.20</td>
<td>1.02</td>
<td>0.86, 1.22</td>
</tr>
<tr>
<td>Tertile 3 (high)</td>
<td>3,714</td>
<td>276</td>
<td>7.4</td>
<td>1.04</td>
<td>0.87, 1.25</td>
<td>1.02</td>
<td>0.86, 1.23</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; HR, hazard ratio.

a Adjusted for age and sex.

b Additionally adjusted for socioeconomic factors: marital status, educational level, and employment status.

c Additionally adjusted for health behaviors: smoking, alcohol consumption, and physical activity.

d Additionally adjusted for morbidity and disability: body mass index, hypercholesterolemia, hypertension, diabetes, cardiovascular disease, cancer, self-perceived health.


<table>
<thead>
<tr>
<th></th>
<th>No. of Participants</th>
<th>No. of Deaths</th>
<th>%</th>
<th>Model 1a (n = 5,267)</th>
<th>Model 2b (n = 5,255)</th>
<th>Model 3c (n = 5,234)</th>
<th>Model 4d (n = 5,187)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>HR 95% CI</td>
<td>HR 95% CI</td>
<td>HR 95% CI</td>
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<tr>
<td>Positive experiences</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stable high support</td>
<td>873</td>
<td>31</td>
<td>3.6</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Stable medium support</td>
<td>909</td>
<td>55</td>
<td>6.1</td>
<td>1.27</td>
<td>0.82, 1.98</td>
<td>1.26</td>
<td>0.81, 1.96</td>
</tr>
<tr>
<td>Stable low support</td>
<td>918</td>
<td>71</td>
<td>7.7</td>
<td>1.57</td>
<td>1.03, 2.39</td>
<td>1.51</td>
<td>0.98, 2.31</td>
</tr>
<tr>
<td>Increasing support</td>
<td>1,310</td>
<td>71</td>
<td>5.4</td>
<td>1.18</td>
<td>0.77, 1.80</td>
<td>1.16</td>
<td>0.76, 1.77</td>
</tr>
<tr>
<td>Decreasing support</td>
<td>1,257</td>
<td>63</td>
<td>5.0</td>
<td>1.19</td>
<td>0.78, 1.83</td>
<td>1.17</td>
<td>0.76, 1.80</td>
</tr>
<tr>
<td>Negative experiences</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Stable low support</td>
<td>898</td>
<td>54</td>
<td>6.0</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Stable medium support</td>
<td>689</td>
<td>27</td>
<td>3.9</td>
<td>0.76</td>
<td>0.48, 1.21</td>
<td>0.77</td>
<td>0.49, 1.23</td>
</tr>
<tr>
<td>Stable high support</td>
<td>1,033</td>
<td>53</td>
<td>5.1</td>
<td>1.03</td>
<td>0.70, 1.50</td>
<td>0.99</td>
<td>0.68, 1.46</td>
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<tr>
<td>Increasing support</td>
<td>1,277</td>
<td>59</td>
<td>4.6</td>
<td>1.00</td>
<td>0.69, 1.45</td>
<td>0.99</td>
<td>0.68, 1.44</td>
</tr>
<tr>
<td>Decreasing support</td>
<td>1,371</td>
<td>86</td>
<td>6.3</td>
<td>1.05</td>
<td>0.75, 1.48</td>
<td>1.02</td>
<td>0.72, 1.44</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; HR, hazard ratio.

a Adjusted for age and sex.

b Additionally adjusted for socioeconomic factors: marital status, educational level, and employment status.

c Additionally adjusted for health behaviors: smoking, alcohol consumption, and physical activity.

d Additionally adjusted for morbidity and disability: body mass index, hypercholesterolemia, hypertension, diabetes, cardiovascular disease, cancer, self-perceived health.
The assessment of social support that we used was based on measuring the positive and negative experiences of social support and did not include distinctive information on different domains of social support such as emotional support, appreciation, informational or instrumental support, or presence of social ties. The Social Experiences Checklist was validated among middle-aged Dutch adults by Van Oostrom et al. (21), who tested and confirmed 2 hypotheses: 1) a negative correlation of neuroticism with positive experiences of social support and a positive correlation with negative experiences of social support, and 2) positively experienced social support related to active coping. No cutoff points for high or low levels of social support according to the Social Experiences Checklist were available, and sum scores were classified into tertiles. To investigate classification of the tertiles, we reran the analyses by using quintiles of the Social Experiences Checklist scores. This different way of ranking showed similar results and did not affect interpretation of the original results.

General nonresponse or item nonresponse might have affected our findings. The initial response rate for the Doetinchem Cohort Study was 62%, which is reasonable for a general survey in the Netherlands. Higher response rates were present among women and older people than among men and the younger age groups. When comparing the study population with the general Dutch population, we found, for example, that the non-Dutch, those with lower levels of education, and smokers were underrepresented in our cohort. Although selection bias could be an issue in our population, it would mainly affect the prevalence estimates, much less so the estimated magnitudes of the associations (20).

Besides the aforementioned selection bias, there could be selection bias due to item nonresponse on the Social Experiences Checklist. Participants for whom items were missing, whether accidentally or deliberately, were excluded from the analysis. Of these excluded participants, a higher proportion died (13.0%) compared with those who were included (7.2%). Furthermore, they were older, had lower levels of education, were more often unemployed and/or unmarried, lived a more health-compromising lifestyle, and had a worse health status. However, we believe that any attenuation of the effects of social support on mortality caused by this bias is minimal. The group of people excluded from both the positive and negative analysis because of at least one missing value was small (7.6%) because the questionnaire was checked for item nonresponse at the community health services by a trained research assistant, and the influence of the confounding variables on the hazard ratios was not larger than the effect of social support on mortality.

The finding that high positive experiences of social support are directly associated with reduced mortality risk adds to the literature on social networks being predictive of health status and mortality (4, 6, 7, 9, 11, 12, 16, 27–32). Most studies included an elderly population, whereas, in the last 10 years, only 2 studies have been known to investigate the association between social relationships and mortality in a general adult population (29, 30). Both studies found that structural aspects of the social network directly influenced mortality in a Danish adult population. Penninx et al. (28), however, demonstrated that functional and perceived aspects of support might be more important predictors of mortality than structural aspects of social support among Dutch elderly people. These authors found that receiving emotional support and having fewer feelings of loneliness increased survival time, whereas a high level of instrumental support was associated with an increased risk of death.

Two different pathways are proposed through which social support may affect health and ultimately influence mortality (33). The first pathway involves behavioral processes. Supportive relationships or social pressure may facilitate either health-promoting or health-damaging behaviors such as smoking, drinking, and physical inactivity. The other pathway involves psychological processes linked to appraisals, emotions or moods, perceptions of control, or sense of coherence and well-being and are thought to enhance adaptation to stressful life events. These behavioral and psychological processes may affect morbidity and mortality; in turn, these associations may be mediated through physiologic processes such as changes in cardiovascular, neuroendocrine, and immune function.

Contrary to positive experiences of support, negative experiences of support seemed to have no association with mortality in this study. This finding was contradictory to our hypothesis that higher levels of negative support would be associated with increased mortality, which was partly based on the study of Newsom et al. (16), who found that higher levels of stable negative aspects of social exchanges were associated with a lower health status over a 2-year period. More studies that differentiate between the positive and negative experiences of support should be performed to confirm our finding and to give more insight into the different mechanisms of how these distinct experiences of support influence health and mortality.

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