

Social Support and Sleep. Longitudinal Relationships from the WOLF-Study

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Aim: To investigate the relationship between two social support dimensions (network and emotional support) and sleep quality and between two social support sources (at and outside work) and sleep quality. **Methods:** The three-wave prospective Work Lipids and Fibrinogen (WOLF) study from Northern Sweden was used including 2420 participants who had filled out a questionnaire on working life, life style and health. Sleep quality was assessed by the Karolinska Sleep Questionnaire (KSQ). Structure and function of social support were measured as network support both at and outside work by Availability of Social Integration (AVSI) and emotional support both at and outside work by Availability of Attachment (AVAT). Logistic regression was used, utilizing variables created to assess development over time. Moreover, reversed causation was tested. **Results:** Improved network support at work decreased the risk of disturbed sleep (OR .65; 95% CI .47 - .90) as did improved emotional support outside work (OR .69; 95% CI .49 - .96). Reporting a constant poor network support at work increased the risk of disturbed sleep (OR 1.53, 95% CI 1.10 - 2.11) as did reporting a constant poor emotional support outside work (OR 1.46; 95% CI 1.02 - 2.05). In men constant good network at work decreased the risk of disturbed sleep (OR .49, 95% CI .34 - .71). Reversed causation analyses indicate some bi-directionality. **Conclusion:** Being able to perceive social support is a human strength promoting sleep. Both dimension (structure and function) and source (at and outside work) of support matters in sleep quality and seem to be related since the structural dimension was more likely to affect sleep when derived from work, whereas the functional dimension affected sleep quality if it was provided outside work. Men's sleep seems to be more sensitive to network support at work. Disturbed sleep may also alter the perception of social support.

Keywords: Sleep Quality; KSQ; Social Integration; Emotional Support; Reversed Causation

Introduction

To perceive social support from friends and family as positive is a psychological strength that provides stress reducing and health beneficial effects (House, Landis, & Umberson, 1988; Mankowski & Wyer, 1997). Another important health promoter is good sleep. However, about 25% of the population in the Western hemisphere (e.g., Ohayon, 1997) suffers from sleep disturbances, a problem that may lead to more serious diseases (e.g., Schwartz et al. 1999; Tsuno, Besset, & Richier, 2005). Previous findings indicate that social support and sleep have stress as a common denominator. Sleep is depicted as the opposite of stress since sleep is easily disturbed by stress (Healy, Kales, Monroe, Bixler, Chamberlain, & Soldatos, 1983; Ekstedt, 2005), whereas social support is a well-known and well-investigated stress reliever (e.g., Berkman & Syme, 1979; House, Landis, & Umberson, 1988; Cohen, Underwood, & Gottlieb, 2000). Cross-sectional associations have been found between social support and sleep (e.g., Nakata, Haratani, Tkahashi, Kawakami, Arito, Fujioka et al., 2001; Nordin, Knutsson, Sundbom, & Stegmayr, 2005; Nordin, Sundbom, & Knutsson, 2008; Pelfrene et al., 2002), and Wahlstedt and Edling (1997) concluded in their longitudinal study that individuals who per-

ceived impaired contacts with coworkers and/or supervisors had a higher risk of reporting disturbed sleep. Moreover, Sinokki, Ahola, Hinkka, Sallinen, Härmä, Puukka et al. (2010) concluded in a longitudinal study on a representative Finnish sample, that low social support especially at work was related to disturbed sleep.

Social support is a dynamic process that provides comfort and aid from friends, family and coworkers. Social support can be divided into its structure and its function. The structure deals with the quantity of network of friends, family and co-workers (House, Landis, & Umberson, 1988). Previous research has consistently showed a positive correlation between network size and health (Cohen, Underwood, & Gottlieb, 2000) and Brugha, Weich, Singleton, Lewis, Bebbington, Jenkins et al. (2005), found that a network including more than three persons was beneficial for mental health. The function of social support entails the more qualitative aspects of support, emotional support presumably being the most important dimension (House, Landis, & Umberson, 1988). Encouragement and comfort, two main ingredients in emotional support, are considered to be of great importance in maintaining health and well-being (Cohen, Underwood, & Gottlieb, 2000).

Some studies have shown the importance of social support *at work* in the relationship with sleep (Nakata et al., 2001; Nordin

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et al. 2005; Wahlstedt & Edling, 1997; Sinokki et al., 2010; Pelfrene et al., 2002). Another important source for support is the life *outside work*, containing family and friends and studies have shown positive relationships between social support from the realm outside working life and sleep (Hanson & Östergren, 1987; Ohayon et al., 1997; Tynjälä et al., 1999), especially in disease (Nordin et al., 2008; Vosvick et al., 2004).

Even though there are quite a few studies confirming a relationship between social support and sleep, no study has to our knowledge investigated the relationship more at depth by studying how central dimensions (such as network and emotional support) develop over time and what matter sources (such as at work and outside work) of support play in sleep. Therefore, the aim of the present study is twofold as it is to, in a longitudinal design, 1) investigate if the development over time in the two social support dimensions, network and emotional support are related to sleep; and 2) investigate if social support from different sources, work and outside work, matter in sleep. The general hypothesis that has been tested so far in previous research is that social support affects sleep and not the other way around. It is however possible that the lack of energy that poor sleep will contribute to and the bad mood that can be associated with disturbed sleep (Pilcher & Huffcutt, 1996) affects the possibility to appreciate coworkers, friends and families. Therefore, reversed analyses are conducted. Because more women report disturbed sleep (Ohayon, 1997) and are considered to have more sources of support since they have been shown to act on more arenas than men (Antonucci, 1994), sex is taken into consideration.

In the present study, the Work Lipids and Fibrinogen (WOLF) study from Northern Sweden, a three-wave prospective epidemiological study is used. This three-wave design makes it possible to study both how development in social support affects sleep quality in a long-term perspective, and if there is reversed causation in this relationship.

Methods

Design and Participants

The present study is based on the WOLF-Norrland study (WOLF-N). The WOLF-N study is a prospective cohort study that aims at investigating the effects of psychosocial work factors and life style on health. All Occupational Health Service units (OHS) in Västernorrland and Jämtland, two provinces in Northern Sweden, were invited to participate between the years 1996 and 1998 (T0). The OHS:s offered a health examination to all the employees served by them and administered questionnaires for the employees to fill out. Fifteen OHS organizations participated and the personnel were trained in standardized measurement procedures. The participants were re-invited to two follow-ups; T1, between 2000 and 2003 and T2, including only a questionnaire, in the fall of 2009. Up to three reminders were sent in both follow-up studies, unless the participant actively declined to participate.

The original sample at T0 consisted of 5092 individuals, out of whom 4715 (93%) responded. The follow-up response rate at T1 was 71%, i.e., 3637 participants. At T2, 2821 (60% from T0; 77% from T1) had filled out the given questionnaire, thus having participated three times in the WOLF-Norrland study. The mean time elapsed between T0 and T1 was five years (± 11 months) and between T1 and T2 seven years (± 6 months). The sample demographics are presented in **Tables 1** and **2**. Ethical

approval was obtained from the ethical committee at Karolinska Institutet.

Outcome and Predictor Variables Sleep

The sleep quality index in the Karolinska Sleep Questionnaire (KSQ; Åkerstedt, Ingre, Broman, & Kecklund, 2008) was used as both a predictor and an outcome variable in this study. The items included were: difficulties falling asleep, restless sleep, repeated awakenings, and premature awakening and the response alternatives ranged from “never” to “most days of the week” (with values from 1 - 5 assigned) the past twelve months (T0 and T1) and the past three months (T2). Internal consistency was high with Cronbach’s alphas of .78 at T0, .82 at T1, and .84 at T2. Each question in the sleep quality index was dichotomized so that the response alternatives “a few times per week” and “every night” were identified as disturbed sleep and coded with the number 1 leaving the other response alternatives coded with 0. Thereafter, the four questions included were summed into a sleepy quality index and those scoring one to four (i.e. had *any* of the symptoms) were identified with disturbed sleep. The criterion was set to be similar to that of insomnia (Buysse, Ancoli- Israel, Edinger, Lichstein, & Morin, 2006). New cases of disturbed sleep were identified as those who reported disturbed sleep according to the definition above at T2 but not at T0 and T1.

Social Support; Dimensions and Sources

The structural dimension of social support was represented by the Swedish version of Availability of Social Integration (AVSI; Henderson, Duncan-Jones, Byrne, & Scott, 1981; Undén & Orth-Gomér, 1989) measuring network support. The questions “There are people in my surrounding I easily can ask for things from, for example borrow tools or kitchen ware” and “Apart from those at home, there are others I can turn to in need” were excluded from this index, since they loaded on a separate factor in a factor analysis and lowered the internal reliability to unsatisfactory levels (a pattern previously shown in another sample; Nordin et al., 2008). The questions on how many friends that were available in different situations were asked both in the context of the work place and outside work and measured on a scale with the response alternatives: none, 1 - 2, 3 - 5, 6 - 10, 11 - 15 and more than 15. Thus, two indexes were formed; network support from the source *at work* (where the summed index was dichotomized at the first quartile [identified at T0 and used on all occasions, i.e., T0, T1 and T2, for comparative reasons] between scale scores 10 and 11), and network support *outside work*, dichotomized at the first quartile (identified at T0 and used on all occasions for comparative reasons) between 11 and 12. This dichotomy equals a cut between five and six friends.

The functional dimension of social support was represented by the Swedish version of Availability of Attachment (AVAT; Henderson et al., 1981; Undén & Orth-Gomér, 1989) measuring emotional support. The questions were asked both in the context of the work place and outside work. Thus, two indexes were formed, emotional support from the source *at work* (where the summed index was dichotomized at the first quartile [identified at T0 and used on all occasions for comparative reasons] between scale scores 5 and 6), and emotional support from the source *outside work* (dichotomized at the first

Table 1.
Frequencies, prevalences, means and standard deviations of the studied variables.

	T0		T1		T2	
	n	%	n	%	n	%
<i>Outcome and predictor variables</i>						
Sleep						
No	1642	8.8	1414	7.5	1612	73.1
Yes	390	19.2	592	29.5	593	26.9
Social network at work						
Large	1373	68.9	1230	63.8	911	6.1
Small	620	31.1	698	86.2	606	39.9
Social network outside work						
Large	1785	88.2	1715	86.3	1797	79.7
Small	239	11.8	272	13.7	458	2.3
Emotional support at work						
Yes	1581	78.4	1548	78.9	1219	79.7
No	435	21.6	414	21.1	310	2.3
Emotional support outside work						
Yes	1512	74.3	1459	72.8	1531	66.7
No	524	25.7	545	27.2	764	33.3
<i>Confounding variables</i>						
Sex						
Man	1987	82.1	1987	82.1		
Woman	433	17.9	433	17.9		
Education						
University	463	16.8	335	16.8		
No university	1710	83.2	1655	83.2		
Age (m ± sd)						
	43.4 ± 8.7		5.1 ± 9.8			
Young	1058	51.4	721	29.8		
Old	1001	48.6	1698	7.2		
Marital status						
Married	1648	8.1	1669	81.6		
Unmarried	409	19.9	376	18.4		
Living alone						
No	1774	86.5	1777	87.5		
Yes	277	13.5	253	12.5		
Children at home						
Yes	772	37.6	971	47.8		
No	1279	62.4	1059	52.2		
Demands at work						
Low	1433	7.5	1376	68.5		
High	600	24.8	634	31.5		
Control at work						
Low	1310	64.0	1371	67.9		
High	738	36.0	648	32.1		
Shift work						
No	1347	65.5	1368	67.4		
Yes	710	34.5	662	32.6		

quartile [identified at T0 and used on all occasions for comparative reasons] between 8 and 9).

Confounding Variables

Sex and *age* were assessed by single questions. *Education* was assessed by the question "Which one of the following schools/educations have you attended?" The response alternative "university education" was contrasted with the other alternatives given. For *marital status* the response alternatives "married/cohabiting" was contrasted with "single", "divorced", and "widow/widower" in combination. *Living alone* was assessed by the question "Do you live alone?" and the response alternative yes was contrasted with the alternatives living with a partner, with children, or with parents. Having *children at home* was estimated by the question "Do you have children living at home?" with the response alternatives yes and no. *Demand and control at work* were estimated by the Swedish version of the Job Strain Questionnaire (JSQ) based on the demand-control model postulated by Karasek and Theorell (1990). As for the demand dimension, the five included questions were summed. For comparative reasons, the distribution at T0 was used as base for identifying those perceiving high demands at work at T0, T1 and T2 and separating them from the rest. The control at work index was treated as one dimension in the same way as the demand index in that T0 was used as base for identifying those reporting low control. A summary score was derived from the answers to the six questions included and the index was subsequently dichotomized on the highest quartile given the reversed scale. *Shift work* was measured with the question "Do you work shifts?" with the response alternatives "no", contrasted with "yes" (including the alternatives: 2-shift, continuous 3-shift, irregular work schedule without night shift, irregular work schedule with night shifts, permanent night work, other type of shift work). Loss of a work place changes ones source of social support. Therefore, *retirement* was considered by the response alternative retired to the question "What is your current occupation?" at T2.

The procedures undertaken to create the variables were the same at T0, T1 and T2. Moreover, variables measuring development (i.e., both change and consistency over time) across the five years of follow-up between T0 and T1 were created for participants where data from both occasions were obtained. Thus, development variables were created for all the social support variables, the sleep quality variable, education, marital status, demand at work, control at work, and shift work by combining the dichotomized variables presented above into four categories; positive responses at both T0 and T1, negative response at T0 and positive response at T1, positive response at T0 and negative response at T1, and negative responses at both T0 and T1 (see **Table 2** for their respective distributions).

Development in age was created by first dichotomizing the age variables on the median age at T0 (44 years) and subsequently combining the variables into below 44 at T0 and T1, below 44 at T0 and above at T1, and above 44 at both T0 and T1 (see **Table 2**).

Statistical Procedure

Spearman's rho was used to estimate correlations between the variables for selection of confounding variables. Logistic regression analyses were used to estimate odds ratios with 95%

Table 2.
Changes in predictor, outcome and confounding variables.

	n	%
Sleep		
Unchanged good sleep T0 & T1	1261	63.6
Disturbed at T0 - good at T1	141	7.1
Good at T0 - disturbed at T1	345	17.4
Unchanged disturbed sleep T0 & T1	236	11.9
Network support at work		
Unchanged large network T0 - T1	991	52.8
Small network T0 - large network T1	203	1.8
Large network T0 - small network T1	313	16.7
Unchanged small network T0 - T1	369	19.7
Network support outside work		
Unchanged large network T0 - T1	1587	81.1
Small network T0 - large network T1	106	5.4
Large network T0 - small network T1	142	7.3
Unchanged small network T0 - T1	122	6.2
Emotional support at work		
Unchanged adequate T0 & T1	1322	68.7
Inadequate T0 - adequate T1	195	1.1
Adequate T0 - inadequate T1	189	9.8
Unchanged inadequate T0 & T1	217	11.3
Emotional support outside work		
Unchanged adequate T0 & T1	1220	61.6
Inadequate T0 - adequate T1	227	11.5
Adequate T0 - inadequate T1	255	12.5
Unchanged inadequate T0 & T1	280	14.1
Education		
Unchanged high	297	14.9
Low T0 - high T1	41	2.1
Unchanged low	1612	81.1
Age		
Below 42 T0 - above 42 T1	682	33.1
Above 42 T0 & T1	376	18.3
Below 42 T0 & T1	998	48.5
Marital status		
Married T0 & T1	1537	75.2
Not married T0 - married T1	131	6.4
Married T0 - not married T1	101	4.9
Unmarried T0 & T1	274	13.4
Living alone		
Not living alone T0 & T1	1673	82.7
Living alone T0 - not living alone T1	99	4.9
Not living alone T0 - living alone T1	77	3.8
Living alone T0 & T1	173	8.6
Children at home		
No children at home T0 & T1	632	31.3
Children at home T0 - no children at home T1	333	16.5
No children at home T0 - Children at home T1	131	6.5
Children at home T0 & T1	926	45.8
Demands at work		
Low T0 & T1	1122	56.6
Low T0 - high T1	239	12.0
High T0 - low T1	280	14.1
High T0 & T1	343	17.3
Control at work		
High T0 & T1	1082	53.9
Low T0 - high T1	282	14.0
High T0 - low T1	205	1.2
Low T0 & T1	439	21.9
Shift work		
No shift T0 & T1	1268	62.5
Shift T0 - no shift T1	99	4.9
No shift T0 - shift T1	69	3.4
Shift T0 & T1	592	29.2

confidence interval. In testing the relationship between social support and sleep quality four models were created for each predictor-outcome combination: Model I, a crude model; Model II, adjusted for baseline sleep/social support (depending on tested direction); Model III, Model II + the social life variables that correlated with each predictor variable respectively, and Model IV (only for the analyses referring to the source at work), Model III + the working life variables correlating to each predictor variable respectively. Analyses were conducted by both testing social support as the predicting factor and sleep as the outcome and vice versa, i.e., sleep as the predicting factor and social support as the outcome (see e.g., Kivimäki, Virtanen, Vartia, Elovainio, Vahtera, & Keltinkangas-Järvinen, 2003). All analyses were conducted using SPSS 18.0 work package.

Results

In this three-wave follow-up study, the prevalence of disturbed sleep increases between T0 and T1 but decreases somewhat at T2 (see **Table 1**). The incidence proportion of disturbed sleep between T0 and T2 (1997-2002) is 21.2% ($n = 504$), between T1 and T2 (2002-2009) 22.5% ($n = 352$), and between T0 and T2 (1997-2009) 18.2% ($n = 246$). Moreover, the prevalence of small networks increases as does the report of low emotional support at T2 compared to T0 and T1 (see **Table 1**).

Table 2 shows the distribution of the development variables. Almost a fifth of the sample reports impaired sleep quality whereas seven per cent report an improvement in sleep quality over time. About 12% report an unchanged poor sleep quality, although the vast majority (63.6%) reports unchanged good sleep quality. Regarding development of social support, a larger change is reported in network support at work than outside work whereas a larger change is reported in emotional support outside work than in emotional support at work.

Reporting an increase in network support at work and more emotional support outside work over time decreases the risk of disturbed sleep at T2. Moreover, reporting constantly low network support at work as well as constantly poor emotional support outside work increases the risk of disturbed sleep at T2. A decrease in network support at work also increases the risk of disturbed sleep, but when controlling for development in social life outside work this risk falls to insignificance (see **Table 3**).

It is plausible that poor sleep contributes to lack of energy and bad mood, which may affect the ability to appreciate friends and families. Reversing the analyses shows that constant poor sleep quality increases the risk of reporting low network support outside work (Model I OR 1.83, 95% CI 1.32 - 2.53; Model II [adjusted for network support at baseline] OR 1.59, 95% CI 1.10 - 2.31; Model III [Model II + adjusted for sex] OR 1.62, 95% CI 1.12 - 2.36; Model IV [Model III + adjusted for demand and control] OR 1.58, 95% CI 1.07 - 2.33) whereas improved sleep quality decreases this risk (Model I OR .55, 95% CI .40 - .76; Model II [adjusted for network support at baseline] OR .63, 95% CI .43 - .91; Model III [Model II + adjusted for sex] OR .62, 95% CI .42 - .90; Model IV [Model III + adjusted for demand and control] OR .63, 95% CI .43 - .94).

To investigate potential differences between men and women in the relationship between social support and sleep, interaction analyses were performed. Interaction effects were found between sex and constant good network support at work (OR .47, 95% CI .22 - 1.00) and post hoc analyses showed the risk of disturbed sleep being lowered in men reporting constantly good

network support at work (Model I: OR .52, 95% CI .38 - .71; Model II [Model I + adjustment for change in sleep between T0 and T1]: OR .51, 95% CI .36-.72; Model III [Model II + adjustment for change in partnership and living alone]: OR .50, 95% CI .35 - .71; Model IV [Model III + adjustment for change in demand, control and shift work]: OR .49, 95% CI .34 - .71). No relationship was found between good network support and sleep in women.

Discussion

The health beneficial power of social support is clearly shown in this study since both an increase in the number of network members at work and improved emotional support outside work reduced the risk of disturbed sleep. These results are to our knowledge, the first to show that an increase and an improvement in social support may help reducing sleeping problems. Both dimension (network and emotional support) and support sources (at work and outside work) were associated with sleep. In fact, dimension and source seemed to be related as sleep was more likely to be affected by network support at work but by emotional support from the realm outside work. Moreover, a bi-directional relationship was indicated by poor network support outside work increasing the risk of poor sleep quality.

Dimensions: Structure and Function

Network support has previously been shown to be the more important dimension of the two under study in relation to sleep disturbances (Nordin et al., 2005; Nordin et al., 2008). Given the previous research showing the structural dimension of social support being closely related to health (Cohen, Underwood, & Gottlieb, 2000; House, Landis, & Umberson, 1988), these results are logical. However, even if in line with previous theory and research on general health (ibid.), the effect that emotional support outside work had on sleep quality has, to the best of our knowledge, not been shown before and is therefore especially interesting and important.

Sources: Work and Outside Work

This study supports both the longitudinal studies by Wahlstedt & Edling (1997) and Sinokki et al. (2010) in that network support at work is related to sleep. Taken together, these results are important. Given the link between sleep and other diseases (e.g., Schwartz et al. 1999; Tsuno, Besset, & Richier, 2005), sleep disturbance caused by poor organizational structures or lack of understanding of social relations at work may lead to sick leaves, costly both for the company and the individual. Interestingly though, our results also suggest that an increase in the numbers of coworkers in the network at work may promote better sleep. The mechanisms here need to be more thoroughly investigated and it is important to point out that the individuals' interpretation of what resources are at hands (Mankowski & Wyer, 1997) also play a significant role in the response patterns given in studies like these. However, the results again confirm previous research on the beneficial power in social support.

This study also adds that social support *outside* work is important. Sinooki et al., (2010) showed that a structural measure of social support (similar to our measure of network support) outside work was important for sleep. However, as mentioned above, the fact that emotional support outside work is

Table 3.

Disturbed sleep at T2 predicted by change in social support variables summarized in models and presented as odds ratios and confidence intervals by logistic regression.

	Model I		Model II		Model III		Model IV	
	OR	CI	OR	CI	OR	CI	OR	CI
NETWORK SUPPORT AT WORK								
<i>Unchanged poor</i>	1		1		1		1	
Poor at T0 - good at T1	.57	.43 - .75	.60	.44 - .81	.59	.43 - .80a	.65	.47 - .90a
Good at T0 & T1	.84	.57 - 1.24	1.08	.71 - 1.64	1.07	.70 - 1.64a	1.14	.73 - 1.73a
<i>Good at T0 & T1</i>	1		1		1		1	
Good at T0-poor at T2	1.51	1.12 - 2.03	1.45	1.05 - 2.00	1.44	1.04 - 1.99a	1.38	.98 - 1.93a
Poor at T0 & T1	1.76	1.34 - 2.32	1.68	1.24 - 2.27	1.71	1.26 - 2.32a	1.53	1.10 - 2.11a
NETWORK SUPPORT OUTSIDE WORK								
<i>Unchanged poor</i>	1		1		1		1	
Poor at T0 - good at T1	.65	.43 - .99	.69	.44 - 1.09	.67	.43 - 1.06b	.74	.46 - 1.19b
Good at T0 & T1	.74	.41 - 1.33	.86	.45 - 1.62	.84	.44 - 1.60b	.30	.49 - 1.80b
<i>Good at T0 & T1</i>	1		1		1		1	
Good at T0-poor at T1	1.16	.78 - 1.73	1.05	.68 - 1.63	1.09	.70 - 1.68b	1.07	.68 - 1.66b
Poor at T0 & T1	1.54	1.01 - 2.33	1.44	.92 - 2.26	1.48	.94 - 2.33b	1.36	.84 - 2.18b
EMOTIONAL SUPPORT AT WORK								
<i>Unchanged poor</i>	1		1		1		1	
Poor at T0 - good at T1	.71	.51 - .99	.82	.57 - 1.17	.80	.56 - 1.16c	.90	.62 - 1.31c
Good at T0 & T1	.84	.54 - 1.31	.94	.58 - 1.52	.94	.58 - 1.51c	.94	.57 - 1.54c
<i>Good at T0 & T1</i>	1		1		1		1	
Good at T0 - poor at T1	1.15	.81 - 1.64	1.18	.81 - 1.71	1.19	.82 - 1.74c	1.15	.79 - 1.69c
Poor at T0 & T1	1.41	1.01 - 1.96	1.23	.85 - 1.76	1.24	.87 - 1.79c	1.12	.77 - 1.62c
EMOTIONAL SUPPORT OUTSIDE WORK								
<i>Unchanged poor</i>	1		1		1		1	
Poor at T0 - good at T1	.69	.51 - .92	.71	.51 - .97	.67	.48 - .92d	.69	.49 - .96d
Good at T0 & T1	.91	.62 - 1.35	.93	.61 - 1.43	.99	.58 - 1.36d	.90	.57 - 1.40d
<i>Good at T0 & T1</i>	1		1		1		1	
Good at T0 - poor at T1	1.04	.75 - 1.43	.99	.70 - 1.40	.98	.69 - 1.36d	1.02	.71 - 1.46d
Poor at T0 & T1	1.46	1.09 - 1.96	1.42	1.03 - 1.95	1.50	.08 - 2.08d	1.46	1.04 - 2.05d

Model I: Crude. Model II: Adjusted for change in disturbed sleep. Model III = Model II + a: change in marriage and living alone; b: change in marriage; c: sex; d: sex. Model IV = Model III a-d + a: change in demand and control at work; b: change in demand and control at work; c: change in control and shift work; d: change in demand and control at work, respectively.

associated with sleep is still a new finding.

The dimensions of social support seems to be associated with source of social support since network support at work most predominantly showed a relationship with sleep as did emotional support outside work. Cutrona and Russell (1990) suggested that social support must match the stressor to be effective. If much work is done in collaboration with others, a certain quantity of coworkers is needed. Thus, being the more quantitative of the measures, network support may be the most important one to get the work done properly and a small network (here less than five coworkers) or a diminished network at work may cause stress, worry and rumination about how to get the work done. Stress, worry and rumination are known disturbers of sleep (Ekstedt, 2005; Kirkegaard-Thomsen et al.,

2003).

Controlling for social life outside work reduced the risk of disturbed sleep predicted by a decrease in network support at work to insignificance. This may partly implicate that family and friends buffer against the stress, worry and rumination that a diminished network support at work may have caused. Emotional support has been shown to be mostly derived from family and close friends (Cohen, Underwood & Gottlieb, 2000) and the family has been regarded as a universal buffer that can relieve stress and worry from other arenas in life, such as work (Cutrona & Russell, 1990).

Women have been suggested to live their lives on more arenas than men which also mean having more sources to derive support from. On the other hand, work has been portrayed as

the most important source of support for men (Shumaker & Hill, 1991). In this light, the increased chance of better sleep due to the report of constant good network support at work only in men is not surprising.

Reversed Causation

Even if causality cannot be established in a study design like this, the results support the commonly tested hypothesis that social support affects sleep. However, one result that deserves special attention is the report of a constant poor sleep quality increasing the risk of reporting a poor network support *outside* work, whereas an improvement of sleep quality decreased this risk. Speculating on these results, disturbed sleep quality may deplete energy resources i.e., resources needed to interact with friends in order to perceive belongingness (Hagerty, Lynch-Sauer, Patusky, Bouwsema, & Collier, 1992). The energy that remains, despite a disturbed sleep, may foremost be spent at work, interacting with coworkers. This prioritization may be required for the work to run smoothly. However, when returning home, the energy depletion due to disturbed sleep (and presumably a hard day's work) may have taken its toll resulting in the perception of low network support since there is no energy left to engage in family and friends.

Strengths and Limitations

In interpreting the results, strengths and limitations need to be considered carefully. The fact that the present study is a three wave longitudinal study is an obvious strength as it gives the possibility to study changes over time and reversed causation and consequently elucidate temporal sequence of social support and sleep. Moreover, the extensive questionnaire included in the study give the possibility of careful confounding control, even if there may be yet other confounding variables at play than those considered here. However, the long periods in between the follow-ups (five and seven years respectively) limit the possibilities to draw conclusions since, especially sleep quality, may have fluctuated several times over the years due to different causes. The fact that the women are outnumbered by the men in this study may have lead to somewhat skewed results in the interaction analyses. Moreover, the sleep quality index was not perfectly comparable over the years because at T0 and T1 the participants were asked to assess their sleep during the past 12 months but at T2 this assessment period was reduced to three months. This may have lead to an underestimation of disturbed sleep according to the criteria of insomnia at T0 and T1 and diluted the results somewhat.

Conclusion

This study shows that the perception of social support is a human strength and an asset in promoting sleep. Both dimension (structure and function) and source (at and outside work) of support matter in sleep quality and seems to be related since the structural aspect (network support) is more likely to affect sleep when derived from work, whereas the functional aspect (emotional support) affected sleep quality if it was provided from outside work. Also bi-directional relationships were found as social support preceded disturbed sleep quality simultaneously to disturbed sleep quality preceding the report of perceived social support. More research on how to strengthen both social support and sleep would benefit health and well-being in

the general population.

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