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HEALTH PSYCHOLOGY | RESEARCH ARTICLE

Predictors of insomnia symptoms in police employees: a longitudinal investigation and comparison of personality and psychosocial work factors

Torhild Anita Sørengaard^{1*}, Eva Langvik¹, Alexander Olsen^{1,2} and Ingvild Saksvik-Lehouillier¹

Abstract: Insomnia is a growing public health concern and a risk factor for reduced health, safety, and performance among workers. This study investigated and compared the predictive value of personality traits and psychosocial factors associated with symptoms of insomnia. The study followed a longitudinal design and included 206 Norwegian police employees (52% men). The predictors of insomnia symptoms were divided into the following groups in the multiple regression analyses: 1) demands, control, and support at work, 2) stress and overcommitment, and 3) the personality traits of the five-factor model. A fourth final model included significant predictors from the initial analyses. The results showed high stability in insomnia symptoms at baseline and follow-up six months later. Neuroticism was the strongest and most stable predictor of insomnia, and associated with an increase in insomnia symptoms after six months. Overcommitment and stress had positive associations with insomnia symptoms but could not predict changes after six months. Social support had a negative association with insomnia, whereas job demands and control at work had no significant association with insomnia symptoms measured at follow-up six months later. The findings demonstrate that the personality trait neuroticism can play an important role in the development and maintenance of insomnia symptoms. Job demands and resources only explained a marginal proportion of variance in insomnia symptoms measured six months later in police employees, indicating that they may be less crucial in the development of insomnia. However, more research on the potential interaction effects between personality and organizational factors is needed. The study highlights the importance of taking personality characteristics into consideration when investigating predictors of insomnia.

Subjects: Environment & Business; Education - Social Sciences; Cultural Studies

Keywords: sleep; insomnia; personality; overcommitment; psychosocial work factors

1. Introduction

Protection and improvement of employee sleep is essential in all organizations due to the effects it has on safety, health, attitudes and performance (Litwiller et al., 2017). Good quality sleep can be considered critically important in the police occupation due the impact sleep has on cognitive and emotional functioning (Lallukka et al., 2018; Saksvik-Lehouillier et al., 2020; Stout et al., 2021) in combination with the societal assignments entrusted to this occupation. Insomnia in workers is

associated with reduced work capacity, higher incidence of sleep-related accidents, and increases the likelihood of sickness absence and future disability (Sivertsen et al., 2014, 2009, 2006). Further, insomnia can be particularly harmful for performance, health and safety in high-risk occupations (Lammers-van der & Kerkhof, 2015), including the police profession. Symptoms of insomnia are frequently reported by police employees and can have adverse effects for the individual, as well as for the public's health and safety (Garbarino et al., 2019; Rajaratnam et al., 2011). Insomnia can also contribute to the development of anxiety and depression (Baglioni et al., 2011; Pallesen & Cusato et al., 2019), and reduce both general and psychosocial well-being (Guglielmi et al., 2018). Insomnia is also associated with unnecessary risk taking, poor decision making and accidents (Budnick & Barber, 2015), making it crucial to prevent in police employees.

Workers often attribute difficulties with sleep to aspects of their work (Linton et al., 2015). A meta-analysis by Yang and colleagues (Yang et al., 2018) on European and Asian workers showed that heavy workload, high demands, job stress, effort-reward imbalance at work and low social support were all associated with insomnia, highlighting the impact of psychosocial work factors on employee sleep. High demands (e.g., workload and time pressure) and few psychosocial resources (e.g., social support and control) at work can have a negative impact on sleep and contribute to sleep disturbances (Åkerstedt et al., 2015, 2012; Edmé et al., 2011; Magnusson Hanson et al., 2011; Portela et al., 2015; Van Laethem et al., 2013). However, the effect sizes and explained variance of job demands and resources on sleep problems have mainly been low to moderate (Linton et al., 2015), indicating that other factors related to work or individual differences may be more important in the development of insomnia.

A possible link between psychosocial work demands, resources and stressors is the individual's perception of and response to these organizational factors. Work stress and overcommitment can have negative effects on sleep and contribute to insomnia (Garefelt et al., 2020; Kudielka et al., 2004; Sonnentag et al., 2016). The association between stress and insomnia is well established (Garefelt et al., 2020; Kalmbach Anderson et al., 2018), and should be included in research focused on factors that contribute to insomnia in the working population. Overcommitment can be defined as excessive striving and commitment to work both during and after working hours, and can function as a maladaptive coping mechanism in response to stress and demands at work (Siegrist, 2002). Hence, overly high personal commitment combined with little detachment from work may be a potential harmful way of trying to handle challenges at work. Overcommitment can contribute to escalating strain on the employee and is associated with sleep difficulties and negative health outcomes (Huyghebaert et al., 2018; Kudielka et al., 2004; Yoshioka et al., 2013).

Growing evidence supports that specific personality traits of the Five-Factor model are associated with sleep problems, and that personality is an important predisposing factor for insomnia (Blanken et al., 2019; Dekker et al., 2017; Pallesen & Cusato et al., 2019; Perlis et al., 2011; Sutin et al., 2020). High neuroticism is associated with an increased risk of insomnia, whereas high conscientiousness, extraversion and agreeableness are generally associated with better sleep (Duggan et al., 2014; Hintsanen et al., 2014; Stephan et al., 2018). Studies on personality and insomnia have remained somewhat inconclusive about which traits that are most closely linked to insomnia severity (Dekker et al., 2017), but neuroticism is recognized as a key predisposing factor (Gurtman et al., 2014). However, the specific role of personality traits in the development of insomnia is not yet clear due to a limited amount of longitudinal research on the subject (Van de Laar et al., 2010). Although one study found that neuroticism predicted symptoms of insomnia in shift workers six months later (Larsgård & Saksvik-Lehouillier, 2017), the call for longitudinal research on the relationship between personality and sleep has not been sufficiently addressed so far (Hintsanen et al., 2014). Lastly, we lack critical knowledge about associations between personality and insomnia in the police profession which can have implications for prevention and treatment of sleep disorders in this occupation.

2. Aim of the study

The literature presented above illustrate complex relationships between numerous work- and individual factors and sleep, which can have implications for both the individual employee and

organization. The risk of developing insomnia is associated with a range of individual (Harvey et al., 2014; Van de Laar et al., 2010; Vedaa et al., 2016) and situational factors, including personality, gender, stress, job demands and shift work (Grewal & Doghramji, 2017; Kim et al., 2011; Vallières et al., 2014). However, we lack specificity in our knowledge about which organizational and individual measures that should be addressed in the prevention of sleep problems and improvement of sleep quality in the working population. There is also a void when it comes to knowledge on which work- or individual factors that have the greatest impact on sleep in the police occupation. By identifying and comparing specific individual and situational factors that contribute to insomnia, the knowledge can be used to develop and implement targeted and more effective interventions aimed at reducing insomnia in police employees.

The aim of the present study is to longitudinally investigate factors associated with insomnia symptoms in police employees. Specifically, this study will compare the explanatory strength and predictive value of the following groups of factors 1) job demands, control and support, 2) stress and overcommitment, and 3) the personality traits of the five-factor model. A comparison between distinct groups of predictors in the same sample have not been conducted earlier and will shed new light on which factors that can be more decisive for development of insomnia in the police occupation. Based on the results from the initial analyses, we will present a final integrated model that includes the significant predictors from the initial investigation, and answer the call for integration of individual and situational factors (Van de Laar et al., 2010). This contribute to new and important knowledge about where organizational and individual measures should be aimed when battling sleep problems and improving sleep quality in the police profession, and provide a contextual framework that is highly sought after in organizational research (Johns, 2017). Based on the literature presented above we propose the following hypotheses:

H1: Job demands measured at baseline will be positively associated with symptoms of insomnia, whereas social support and job control measured at baseline will be negatively associated with symptoms of insomnia measured six months later.

H2: Stress and overcommitment measured at baseline will be positively associated with symptoms of insomnia measured six months later.

H3: Neuroticism measured at baseline will have a positive association with symptoms of insomnia measured six months later, whereas extraversion, conscientiousness, openness and agreeableness measured at baseline will be negatively associated with symptoms of insomnia measured six months later.

3. Methods

3.1. Design and procedure

The present study is based on self-report data from the longitudinal study “Sleep, activity, psychosocial work environment and police health” (SAPPH), which includes participants employed in a police district in Norway. Data was collected through online questionnaires distributed by e-mail to all employees in the police district. The baseline data collection (Time 1) was conducted in October 2018 and the follow-up data collection (Time 2) took place in May 2019. The response rate at Time 1 was 40% (N = 410). Of those who participated at baseline, 50% (N = 206) also answered the second questionnaire containing all variables, except from demographic variables and personality traits, at follow-up. The project was approved by the Regional Committee for Medical and Health Research Ethics (REK) of Central Norway. The participants provided electronic informed consent and the study was conducted according to The Helsinki Declaration and European general data protection regulations (Voigt & Von Dem Bussche, 2017; World Medical Association, 2013)

3.2. Sample

The longitudinal sample consisted of 100 (48%) females and 106 (52%) males. The participants age ranged from 22 to 65 years ($M = 42.48$, $SD = 10.71$). A total of 63 participants (31%) reported that they had leadership responsibilities, whereas 142 (69%) were ordinary employees. The participants had assignments related to operational work, e.g., patrolling and manning the operational central (40%), investigation (35%), administrative work (27%) and civil justice (12%). Some of the participants had overlapping tasks, e.g., a mix of operational, investigative, and administrative tasks. Of the participants who answered the question, 95 (46%) worked daytime only, 15 (7%) worked both evening and daytime and 96 (47%) worked rotating shifts (day, evening, and night shifts). This variable was later dichotomized to the variable labelled “rotating shift”, where 0 = not working shifts including nights (53%) and 1 = working shifts including nights (47%). No employees worked only evening or night shifts. On average, the shift workers had 12 years ($SD = 9.95$) experience in rotating shifts.

3.3. Measures

The questionnaires included items measuring demographic variables, work time schedule, psychosocial work factors, stress, overcommitment, insomnia and the personality traits of the Five-factor model. The questionnaires were administered in Norwegian.

Control variables. Gender, age, and rotating shift work were included as control variables in the present study. Gender was coded as 0 (male) and 1 (female), whereas age was a continuous variable. The variable rotating shift was coded as (0) not enrolled in rotating shifts including nights and enrolled in rotating shifts including nights.

3.3.1. Insomnia

The Bergen Insomnia Scale (BIS; Pallesen et al., 2008) contains six items that assess symptoms of insomnia based on the criteria in the Diagnostic and Statistical Manual of Mental Disorders-IV (American Psychiatric Association, 2000). The participants were asked to indicate how many days a week during the last month they have struggled with specific symptoms of insomnia. The first three items measured sleep onset, sleep maintenance, and early morning awakenings, respectively. The last three items assessed not feeling adequately rested, experiencing daytime impairment due to poor sleep and being dissatisfied with current sleep. In the present study, we used the continuous version of the scale as a measure of insomnia that ranges from 0 (no symptoms of insomnia) to 42 (strong symptoms of insomnia). The instrument has shown good convergent and discriminative validity in previous studies, and is considered a reliable measure of insomnia (Pallesen et al., 2008).

3.3.2. Job demands, control and social support

The General Nordic Questionnaire for Psychological and Social Factors at Work (QPS-Nordic; Lindström et al., 2000) was used to measure psychosocial factors at work. Quantitative work demands were measured with four items, whereas control over decisions and total support at work were assessed through five items each. The answers were given on a five-point Likert-type scale ranging from 1 “very seldom or never” to 5 “very often or always”. The subscale mean scores were calculated through their corresponding items. The questionnaire and scales included have shown satisfying reliability and been repeatedly validated in multiple samples (Elo et al., 2000; Wännström et al., 2009).

3.3.3. Stress

Stress was measured with the Norwegian version of the Perceived Stress Scale (Cohen, 1994). The Perceived Stress Scale (PSS) is one of the most widely used psychological instrument for measuring the perception of stress. The instrument measures the degree to which current situations in the individual’s life are considered stressful. The answers were given on a five-point rating scale ranging from “0 = never” to “4 = very often”. After reversing the scoring of the positively stated items, the total score was calculated by summing the answers given to each item. The scale ranges from 0 to 40, where higher scores indicate high levels of perceived stress.

3.3.4. *Overcommitment*

We measured overcommitment with six items from the Norwegian short version of the Effort-Reward Imbalance Questionnaire (ERI-Q; Siegrist et al., 2008). The items measure inability to withdraw from work and disproportionate irritability (Siegrist et al., 2004). The answers were given on a four-point rating scale ranging from “1 = strongly disagree” to “4 = strongly agree”. The scale ranges from 6 to 24, and higher scores indicate higher degree of overcommitment. The instrument has satisfying psychometric properties (Siegrist et al., 2008).

3.3.5. *Personality*

The personality traits of the Five-factor model were assessed using the Norwegian version of the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992; Martinsen et al., 2005; McCrae & Costa, 2004; Nordvik, 2005). NEO-FFI is considered a comprehensive measure of personality with good psychometric properties (Costa & McCrae, 1992). The instruments comprise of 60 items, where 12 items measure each of the five distinct personality traits: neuroticism, extraversion, openness, agreeableness and conscientiousness. The participants were asked to indicate to which degree they agree with each of the statements on a scale ranging from 1 (strongly disagree) to 5 (strongly agree). The responses were computed to a mean score for each of the five personality traits.

3.4. *Statistical analyses*

The data were analyzed with the Statistical Package for Social Sciences (SPSS) for Windows (version 27.0). We applied listwise deletion to treat missing data in the analyses. Pearson correlation analysis was used to examine the correlations between all variables included in the study measured at Time 1 and Time 2. Multiple linear regression analyses with insomnia measured at Time 2 as dependent variable were conducted separately with the following groups of independent variables: 1) quantitative job demands, control and social support at work, 2) stress and overcommitment to work and 3) neuroticism, conscientiousness, extraversion, agreeableness and openness. All regression analyses included gender, age, and rotating shift work including nights as control variables. To adjust for the effects of baseline symptoms of insomnia and investigate if the variables could predict changes in symptoms, insomnia measured at Time 1 was included in a separate model. Lastly, we performed a final multiple linear regression analysis including the strongest predictors in the three initial regression analyses to investigate the combined effects of psychosocial and individual factors predicting insomnia. No major violation of the assumptions for regression analysis was detected. All VIF (1.17–2.39) and tolerance values (0.37–0.85) were within acceptable range, indicating low levels of multicollinearity between the predictors.

4. *Results*

Table 1 shows the descriptive statistics for all continuous variables included in the present study. The stability coefficient for insomnia was high ($r = .73$, $p < .001$). All scales showed acceptable to good internal consistency, except from agreeableness where Cronbach’s alpha was .67.

Table 2 shows correlations between continuous variables included in the study. Insomnia measured at baseline and follow-up had positive associations with job demands, stress, overcommitment and neuroticism, and negative associations with control, support at work, and extraversion. Openness, agreeableness, conscientiousness, and age had no significant association with insomnia at either time. The correlation between insomnia measured at baseline and follow-up was high.

Results from the multiple regression analyses on associations between baseline variables and symptoms of insomnia measured at follow-up six months later are shown in Table 3. The regression model consisting of control variables, job demands, control and support at work explained 7% of the variance in insomnia measured six months later ($F(6, 186) = 3.47$, $p = .003$). Support at work had a negative association with insomnia, but the association was no longer significant in the model that included insomnia measured at baseline as control variable. Job demands and control had no significant association with insomnia. The regression model that included control variables, stress and overcommitment

Table 1. Descriptive statistics and internal consistency (N = 189–206)

Variable	α	Min	Max	M	SD
Job demands T1	.71	1.50	5.00	3.09	0.68
Control T1	.75	1.00	4.80	2.78	0.73
Social support T1	.82	1.20	5.00	3.95	0.73
Stress T1	.83	0.00	32.00	12.53	5.91
Overcommitment T1	.81	6.00	23.00	14.12	3.42
Neuroticism T1	.86	1.00	4.25	2.26	0.66
Extraversion T1	.81	1.83	4.83	3.64	0.54
Openness T1	.72	1.83	4.92	3.19	0.52
Agreeableness T1	.67	2.67	4.83	3.85	0.42
Conscientiousness T1	.79	2.58	4.92	3.86	0.43
Insomnia T1	.85	0.00	42.00	11.25	8.81
Insomnia T2	.84	0.00	38.00	10.63	8.51

T1 = baseline, T2 = 6-months follow-up.

explained 21% of the variance in insomnia six months later ($F(5, 179) = 10.70, p < .001$). Both variables had a positive association with insomnia, but the relations were no longer significant after including baseline insomnia in the model. The regression model that included control variables and the traits from the five-factor model explained 22% of the variance in insomnia six months later ($F(8, 178) = 7.23, p < .001$). Neuroticism was the single trait that had a positive association with insomnia both before and after the analysis was adjusted for baseline symptoms of insomnia. Agreeableness had a positive association with insomnia in the model that adjusted for baseline insomnia. Extraversion, openness, and conscientiousness had no significant association with insomnia measured six months later in either model. An additional separate regression analysis containing age and gender only, showed that these variables explained 2% of the variance in insomnia measured at follow-up ($F(L(2, 197) = 2.95, p < .055$). This model was, however, not statistically significant.

The integrated regression analyses (Table 4) that included the variables with significant associations to insomnia in the previous analyses (i.e. support, stress, overcommitment, and neuroticism) explained 26% of the variance in insomnia six months later ($F(4, 178) = 17.22, p < .001$). Overcommitment and neuroticism had a positive association with symptoms of insomnia at follow-up, but only neuroticism remained significant in the model that included baseline symptoms of insomnia. Stress and social support had no significant association with insomnia in the integrated model.

5. Discussion

The results in the present study showed that the personality trait neuroticism can be important for the development and maintenance of insomnia symptoms in the police occupation. The regression model consisting of personality traits explained the greatest amount of variance in symptoms of insomnia, closely followed by the model that included overcommitment and stress. It is, however, important to note that neuroticism was the primary personality trait that contributed to the explained variance in the personality model. Neuroticism had stable positive associations to insomnia in all models where it was included. It also predicted changes in insomnia symptoms six months later, i.e., higher scores on this trait was associated with an increase in symptoms. Agreeableness had a weak positive association with insomnia, but only after adjusting for baseline symptoms of insomnia. This result should be interpreted with caution. No significant association was found between extraversion, openness, conscientiousness, and insomnia. Stress and overcommitment were associated with insomnia symptoms measured six months later but did not predict changes after including baseline

Table 2. Correlations between all continuous variables (N = 189–206)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age	-												
2. Job demands	-.09	-											
3. Control	.17*	-.11	-										
4. Support at work	-.14	-.10	.28**	-									
5. Stress	-.19**	.29**	-.20**	-.26**	-								
6. Overcommitment	.00	.53**	.03	-.16*	.51**								
7. Neuroticism	-.04	.06	-.16*	-.28**	.66**	.37**	-						
8. Extraversion	-.01	.04	.00	.15*	-.30**	-.05**	-.51**	-					
9. Openness	.02	.03	.16*	.09	-.09	.51**	-.18*	.30**	-				
10. Agreeableness	.09	-.02	-.03	.10	-.15*	-.03	-.25**	.26**	.21**	-			
11. Conscientiousness	.02	.14	.10	.21**	-.33**	-.06	-.39**	.34**	.13	.21**	-		
12. Insomnia T1	-.01	.20**	-.21**	-.25**	.46**	.43**	.48**	-.24**	.01	-.12	-.12	-	
13. Insomnia T2	-.04	.17*	-.15*	-.22**	.40**	.39**	.47**	-.23**	-.02	.00	-.12	.73**	-

*p < .05 **p < .01 T1 = baseline, T2 = 6-months follow-up.

Table 3. Baseline variables associated with insomnia symptoms measured at six-month follow-up in police employees (N = 183–193)

Separate regression models	Insomnia T2											
	Not adjusted for insomnia T1						Adjusted for insomnia T1					
	β	SE B	p	95% CI B Lower	Upper	R ^{2*}	β	SE B	p	95% CI B Lower	Upper	R ^{2*}
Job demands and resources						.07						.53
Gender	.15	1.23	.041	0.11	4.97		.03	0.89	.540	-8.03	1.83	
Age	-.05	0.06	.519	-0.17	0.08		-.02	0.05	.755	-1.21	2.31	
Rotating shift	.01	1.45	.893	-2.66	3.05		.07	1.03	.247	-0.10	0.08	
Job demands	.13	0.90	.065	-0.11	3.45		.03	0.65	.511	-0.84	3.24	
Control	-.05	0.91	.522	-2.39	1.21		.06	0.66	.304	-0.85	1.71	
Support at work	-.19	0.87	.013	-3.87	-0.46		-.04	0.63	.414	-0.62	1.98	
Insomnia T1 ^a							.72	0.05	.000	-1.76	0.73	.54
Stress and overcommitment						.21						
Gender	.12	1.17	.076	-0.22	4.41		.02	0.91	.719	-1.47	2.13	
Age	.05	0.06	.535	-0.08	0.16		.01	0.05	.883	-0.08	0.10	
Rotating shift	.14	1.31	.067	-0.17	4.99		.09	1.01	.145	-0.51	3.46	
Stress	.27	0.12	.001	0.16	0.62		.06	0.09	.387	-0.10	0.26	
Overcommitment	.26	0.19	.001	0.27	1.03		.07	0.15	.248	-0.13	0.48	
Insomnia T1 ^a							.68	0.06	.000	0.54	0.77	
Personality						.22						.55
Gender	.06	1.27	.417	-1.48	3.55		-.01	0.97	.813	-2.14	1.68	
Age	-.04	0.06	.606	-0.15	0.09		-.02	0.04	.726	-0.10	0.07	
Rotating shift	.09	1.29	.232	-1.00	4.11		.08	0.98	.159	-0.55	3.31	
Neuroticism	.47	1.14	.000	4.04	8.53		.17	0.93	.016	0.43	4.09	
Extraversion	-.07	1.30	.365	-3.75	1.39		-.04	0.98	.520	-2.57	1.31	

(Continued)

Table 3. (Continued)

Separate regression models	Insomnia T2											
	Not adjusted for insomnia T1						Adjusted for insomnia T1					
	β	SE B	p	95% CI B Lower	95% CI B Upper	R ^{2*}	β	SE B	p	95% CI B Lower	95% CI B Upper	R ^{2*}
Openness	.07	1.16	.340	-1.18	3.41		.00	0.88	.982	-1.76	1.72	
Agreeableness	.12	1.50	.103	-0.50	5.41		.13	1.13	.014	0.59	5.05	
Conscientiousness	.03	1.49	.673	-2.31	3.56		.00	1.12	.931	-2.31	2.12	
Insomnia T1 ^o							.66	0.06	.000	0.53	0.76	

T1 = baseline, T2 = 6-months follow-up, R^{2*} = adjusted

Table 4. Integrated model for predictors of insomnia symptoms in police employees (N = 183)

	Insomnia T2											
	Not adjusted for insomnia T1					Adjusted for insomnia T1						
	β	SE B	p	95% CI B Lower	Upper	R ²	β	SE B	p	95% CI B Lower	Upper	R ²
Integrated model						.26						.54
Support at work	-.09	0.77	.199	-2.52	0.53		-.00	0.62	.950	-1.25	1.18	
Stress	.04	0.13	.706	-.021	0.32		-.05	0.11	.489	-.028	0.14	
Overcommitment	.24	0.19	.002	0.23	0.97		.07	0.15	.265	-.013	0.47	
Neuroticism	.33	1.15	.000	2.12	6.65		.16	0.93	.023	0.30	3.96	
Insomnia T1 ^a							.65	0.06	.000	0.51	0.75	

T1 = baseline, T2 = follow-up, R² = adjusted

measures of insomnia in the analyses. Job demands, control and support explained only a marginal proportion of the variance in insomnia symptoms measured six months later. Social support at work was negatively related to insomnia, but only before the model was adjusted for previous symptoms of insomnia. Job demands, control at work and rotating shift work including nights had no significant association with insomnia in either model. However, it should be noted that insomnia symptoms showed high stability between Time 1 and Time 2, which most likely influenced the results from the models that included baseline measures of insomnia. Overall, neuroticism was the single variable that could predict changes in insomnia symptoms in the final integrated model after adjusting for insomnia symptoms measured at baseline. This finding indicates that neuroticism is an important predictor of insomnia also when related concepts like stress are included in the analysis. The results in this study supported the second hypothesis and provided partial support for the first and third hypothesis.

6. The impact of neuroticism on sleep

The results showed that neuroticism was the strongest and most stable predictor of all variables included in the analyses, which supports parts of the third hypothesis. This personality trait could also predict changes, i.e. increases, in insomnia symptoms six months later. These findings are in line with previous studies on neuroticism and sleep, which have shown that high neuroticism contribute to poorer sleep and more sleep problems (Booker et al., 2018; Duggan et al., 2014; Gray & Watson, 2002; Gurtman et al., 2014; Križan & Hisler, 2019). This association may be a result of neuroticism as a general vulnerability factor for negative health outcomes (Lahey, 2009). Hyperarousal and stress-related responses are by many considered the leading mechanisms behind insomnia and poor sleep, and high neuroticism may fuel this relationship (Altena et al., 2017; Bonnet & Arand, 2010; Cellini et al., 2017; Fernández-Mendoza et al., 2010; Kalmbach, Cuamatzi-Castelan et al., 2018). Another possible link between neuroticism and insomnia is through negative affect and rumination, which may greatly impair sleep (Slavish et al., 2018). However, Gurtman and colleagues (Gurtman et al., 2014) found that sleep-related cognitive distortions and pre-sleep arousal are stronger mediating factors in the relationship between neuroticism and insomnia severity than negative affect is. Although the mean level of neuroticism in this study was low compared to the four other personality traits, our findings demonstrate that higher scores on neuroticism in police employees can make them more prone to develop insomnia.

Agreeableness only became a significant predictor after adjusting for previous symptoms of insomnia and had no significant association with insomnia in the initial correlation or regression analyses, suggesting that the effect of agreeableness might be spurious. Agreeableness has in previous studies been associated with better sleep and fewer sleep problems (Dekker et al., 2017; Hintsanen et al., 2014), which further supports that this single finding don't necessarily show a true relationship. However, employees in the police profession experience close contact with people in distress daily. This can be wearing for highly agreeable and emphatic individuals, which may experience sleep problems due to emotional strain and moral distress (Cheval et al., 2018). A combination of high agreeableness-high neuroticism may also contribute to a link between agreeableness and insomnia symptoms, and this association should be further explored in future research. No significant associations were found between extraversion, openness, conscientiousness, and insomnia. Overall, these findings demonstrate that the relationship between neuroticism and insomnia symptoms is more consistent compared to the relationship between the remaining four traits and insomnia. More research is needed to establish the role of agreeableness, extraversion, openness and conscientiousness in the development and maintenance of insomnia symptoms.

7. Overcommitment and the importance of detachment from work

After neuroticism, overcommitment was the second strongest predictor of insomnia symptoms in the integrated model. This finding supported the second hypothesis. However, overcommitment could not predict changes in insomnia after adjusting for baseline symptoms. At its very core, overcommitment is related to not being able to stop thinking about work during leisure time and

having difficulties unwinding and sleeping as a result (Lehr et al., 2009). Overcommitment can make it difficult for police employees to withdraw from work during leisure time and may be related to a need for approval from leaders and co-workers (Violanti et al., 2018). Overcommitted employees can have problems with letting go of their work (Avanzi et al., 2020), which can create a prolonged exposure to work stressors resulting in symptoms of insomnia. If the employee is occupied with thoughts or worries related to work when they are off duty, it can hamper recovery and cause further strain on the individual (Siegrist, 2002). The inability to turn off intrusive thoughts was early identified as a major cause of insomnia (Borkovec et al., 1983), indicating that unwanted thoughts about work can contribute to work-related insomnia among police employees. Psychological detachment from work during leisure time is an important factor that protects the general well-being of workers (Sonnentag et al., 2010) and may contribute to a lower risk of work-related insomnia. The relationship between overcommitment and insomnia deserves greater attention both in future research and in the prevention and treatment of insomnia in police employees.

8. Stress and insomnia

In accordance with previous research (Basta et al., 2007; Kalmbach Anderson et al., 2018; Morin et al., 2003), stress was positively associated with insomnia in the present study, supporting hypothesis two. However, the association was only significant before adjusting for baseline level of insomnia and had no significant association with insomnia in the integrated model. This indicates that although stress is associated with insomnia, it may be less effective in predicting change in symptoms over the course of six months. The relationship between stress and insomnia is well established and stress is considered a major driving force behind sleep problems (Drake et al., 2014; Morin et al., 2003). Stress is associated with physiological and psychological arousal and release of stress hormones like cortisol and adrenaline (Axelrod & Reisine, 1984). Stress can both impair the individual's physical ability to sleep (e.g., by elevating cortisol levels and disturbing melatonin secretion), and contribute to intrusive thoughts and worrying about stressors (Lovallo & Buchanan, 2017). The stressor can be a real or potential threat to the individual, and the impact of the stressors are highly dependent on the individual's subjective perception and reaction to it. Hence, stress can be closely related to the individual level of neuroticism and overcommitment. More research on the interaction between stress, overcommitment and neuroticism in relation to sleep can give important insight to the underlying pathways and mechanisms contributing to insomnia.

9. Job demands, control and social support at work

High job demands, low control and low social support at work was associated with insomnia in the correlation analysis but did not have good predictive value in the regression analyses. Social support at work had a negative association with insomnia, whereas job demands, and control did not predict insomnia six months later. However, after adjusting for baseline symptoms of insomnia, the association between support and insomnia was no longer significant, i.e. social support could not predict changes in insomnia symptoms after six months. Combined, these results show that psychosocial work factors may be less important than individual differences in the development of insomnia symptoms in the police occupation. Previous research has found that few job resources and high demands at work can be associated with sleep problems (Åkerstedt et al., 2015; Fekedulegn et al., 2016; Linton et al., 2015; Van Laethem et al., 2013), but we did not find similar results in this study.

Our study included Norwegian police employees, and distinct characteristics of the Norwegian work life (e.g., high autonomy, less hierarchical structures, strong worker rights and welfare benefits) and the organization of the Norwegian police force may have influenced the results. A second important remark is that individuals with high quantitative demands (i.e. high time pressure, workload, and overtime) or sickness absence during the data collection may not have had the time nor opportunity to participate in the study. However, the level of demands, social support and control were close to the normative values of the QPS-Nordic (Lindstrøm et al., 2000),

indicating that the scores can be compared to those of other working populations. High workload and time pressure, as well as low support and control, can be managed in unique ways depending on the personality and personal commitment to work of the individual employee. How employees perceive, respond and cope with challenging factors at work can be more important than the challenge itself (Garrosa et al., 2010; Gottschling et al., 2016; Harvey et al., 2014). This includes the extent to which the employees are able to not focus, think or worry about work before going to sleep, which can have more to do with their personality and stable thought and emotional patterns, and less to do with what they experience at work.

10. Shift work, age, and gender

Rotating shift work including nights had no significant relationship to insomnia symptoms in any of the models. Shift work, and especially rotating shifts and nights shifts, is generally associated with a higher risk of sleep problems (Flo et al., 2013). The sample characteristics of this study is important to take in to consideration, as male gender, younger age and low scores on neuroticism are associated with higher shift work tolerance and less negative consequences of shift work (Saksvik et al., 2011). Higher scores on neuroticism have been associated with a higher risk of sleep problems following shift work in previous research (Booker et al., 2018), which can help explain why we did not find similar results in our study. Further, the sample police district in the present study followed a forward rotating shift arrangement which can reduce strain on the employees enrolled in rotating shift and contribute to less sleep disturbances (Kecklund et al., 2008; Taylor et al., 2019). This may have influenced the association between rotating shifts and insomnia and reduced the consequence of sleep problems related to unfavorable work schedules. Insomnia is more often reported by females and older individuals (Morphy et al., 2007; Zhang & Wing, 2006), but except for a weak positive association between gender and insomnia in the first model, we did not find significant associations between age, gender and insomnia in our study. The relationship between age, gender and insomnia have shown to be inconsistent in previous research (Pallesen et al., 2001, 2014), and may be influenced by confounding variables like activity level, life events and socioeconomic status.

11. Strength and limitations

The study followed a longitudinal design with two measurement points six months apart, which is one of the main strengths of the study. Additionally, the study applied was well-established and validated measures of all included variables. However, the study could have been further strengthened with multiple measures over a longer timeframe, which would have made it possible to further monitor and examine effects and relations across time. Insomnia showed high stability between Time 1 and Time 2, influencing the results regarding predicting changes in insomnia symptoms after six months. The version of the Bergen Insomnia Scale applied in this study uses the one month duration of insomnia symptoms according to DSM-IV, whereas DSM-V states that the symptoms should have been present for at least three months (American Psychiatric Association, 1994; , 2013). This may have led to higher reports of insomnia symptoms than if the three-month criteria had been specified in the questionnaire, which is important to take into consideration when interpreting the results and comparing the findings to other studies. For example, the associations between predictors and outcome may have been inflated due to the proximity between the experienced symptoms and the timing of the baseline and follow-up questionnaire. Further, instead of investigating predictors of insomnia symptoms, the sample could have been divided into insomniacs and non-insomniacs using the diagnostic cut-off criteria in the Bergen Insomnia Scale. This would have enabled the use of logistic regression analysis to model the probability of the predictors leading to insomnia. However, the aim of this this study was to investigate and compare predictors of insomnia symptoms, using linear regression analysis was best suited for the purpose of this study. Another limitation is that other sleep problems (e.g., restless legs, nightmares, and sleep apnea) were not assessed in this study, which prevents investigation of these conditions as underlying causes for the insomnia symptoms.

It should also be noted that neuroticism and overcommitment had strong correlations to stress. Individuals high in neuroticism often report negative symptoms to a larger degree than individual low on neuroticism (Larsen, 1992), but high neuroticism is also a genuine vulnerability factor to stress and illness (Johnson, 2003). Hence, a strong correlation is not unexpected. However, the variables did not show significant signs of multicollinearity in the regression analysis. Although the response rate can be considered satisfying in organizational research (Baruch & Holtom, 2008), replication of the findings in larger samples and in other occupations is encouraged to further strengthen the conclusions. The sample consisted of police employees with equal gender distribution and satisfying dispersion in age that reflects the Norwegian police force, making it possible to generalize the findings to other districts and police forces with similar work and demographic characteristics. They may, however, be less generalizable to occupations or police employees in countries with different gender distribution and other working conditions, e.g., lower autonomy at work, other demands, and higher crime rates. Lastly, it should be noted that selection bias (Nohr & Liew, 2018) and self-report bias (Donaldson & Grant-Vallone, 2002) can have influenced the results and conclusions in this study.

12. Theoretical and practical implications

The findings in this study highlight the importance of taking personality characteristics, and especially neuroticism, into consideration together with situational factors when investigating antecedents to insomnia in the police occupation. Explanatory models for insomnia are under continuous improvement (Perlis et al., 2011; Pigeon & Cribbet, 2012), but the impact of personality traits have not been sufficiently investigated in the current literature. Future research is encouraged to further investigate and develop an integrated perspective on insomnia in the working population, including possible mediating or moderating relationships through personality and coping of stress and demands at work. The shared psychosocial working environment and the available demands and resources may be similar for the police employees, but their level of neuroticism and personal commitment to work can make them vulnerable for experiencing sleep problems related to organizational and psychosocial work factors. .

The impact of individual responses to and coping of situational factors are highly important to include when designing, implementing, and evaluating organizational and clinical measures aimed at insomnia symptoms. Individual differences can have implications for prevention and treatment of insomnia not only in the police occupation, but also in the general working population. More specific, the general vulnerability factor related to neuroticism can impact how well individuals respond to measures aimed at reducing the risk of sleep problems. Acknowledgement of the role of neuroticism in the development of insomnia can improve organizations effort directed at employee's health and safety and make it possible to develop more targeted interventions. Further, this study shows that overcommitment to work may have adverse effects on sleep, indicating that having a strong personal commitment to work is not always positive. This needs to be acknowledge by organizations, and especially leaders that values employees that perform above and beyond what is expected of them, even at the expense of the employees' personal well-being.

A relatively new concept labeled *sleep leadership* (Adler et al., 2021; Gunia et al., 2015; Sianoja et al., 2019), highlights the impact of leader support and understanding on employee sleep and associated organizational outcomes. More specific, a leader that facilitates good employee sleep through optimizing work schedules, balancing job demands and resources, reducing stress inducing factors and communicate clear expectations as a mean to reduce unhealthy commitment to work may help reduce the development of insomnia symptoms related to work factors. Additionally, expanding the knowledge about individual differences among leaders can enable them to find solutions that targets the specific challenges for each employee that struggles with sleep. Interventions aimed at preventing or treating insomnia in the working population can benefit from personalized measures that do not focus solely on work-related stressors in the form of demands and shift work, but also how the employees tolerate and cope with them individually. Examples of such personalized measures are offering knowledge-based courses on

sleep, stress perception and coping to high-risk individuals, as well as development of a work culture that both facilitates and encourage active recovery and detachment from work after working hours. Studies on sleep training courses in the police have shown promising results, and demonstrate that this type of sleep promoting intervention can improve sleep quality and reduce symptoms of insomnia in occupational settings (Garbarino et al., 2020). Lastly, establishing a safe and supportive work environment where occupational sleep health can be discussed between leaders and employees may have positive effects on the prevalence of insomnia in both the police occupation and the general working population.

13. Conclusion

The findings show that the personality trait neuroticism can be important for the development and maintenance of insomnia symptoms in police employees. Stress and overcommitment also had positive associations with insomnia, and are crucial factors to evaluate and address in the prevention of sleep problems in workers. Lastly, quantitative job demands, control and social support had weak or non-significant associations with insomnia symptoms, indicating that these psychosocial work factors may be less important in the development of insomnia in police employees. However, the associations between job demands, job resources and sleep should be further investigated. Neuroticism was the strongest and most stable predictor of insomnia symptoms measured at follow-up six months later, which accentuates the importance of this personality trait in relation to sleep problems. The study highlights the value of taking personality characteristics into consideration when investigating predictors of insomnia among workers, and that individual differences may have implications for prevention and treatment of insomnia. Applying an integrated approach when investigating predictors of insomnia may be more beneficial and have more explanatory power compared to investigating personality and psychosocial work factors separately.

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