

Running Head: PERSONALITY PREDICTS INSOMNIA IN SHIFT WORKERS

The Predictive Power of Personality Traits
on Insomnia Symptoms:
A Longitudinal Study Among Shift Workers

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Foreword

My deepest thanks goes out to Ingvild Saksvik-Lehouillier, who has functioned as my mentor and supervisor. More than that, you have been my guide through the dark depths of buttons, variables and numbers that is SPSS; a reliable source of knowledge; ever-positive, ready to respond on the shortest of notice to my many questions and always believing that this paper could be finished in due time however far behind schedule I was. I would also like to thank my fellow students for the lengthy, in-depth, on-topic conversations we've had throughout the semester over lunch, frequent coffee breaks and during the late hours of the nights in Trondheim; Einar and Martin for (almost) helping me reach my goal of doing a perfect handstand; my family, for receiving me when I require sustenance, care and nurturing; Christoffer and Jonas, for 24/7 online tech- and otherwise unspecified support, in the form of funny pictures on the internet; Marius, for sticking with me all these years; and last, but definitely not least, Ida, for supporting me unconditionally, and always being there.

Abstract

Shift work can have adverse effects on employees' health, including symptoms of insomnia. This may cause severe problems both for employee and employer. The personality variables morningness, neuroticism and extraversion, along with some demographic variables (e.g. gender, age) have been found to correlate with insomnia symptoms, but predictive data have been scarce. This study sought to discover whether personality variables could predict insomnia. A hierarchical longitudinal (six months) regression study was conducted (N=96). Respondents were shift workers employed in the health or social sector in Trondheim, Norway. Age, gender, children living at home and shift schedule were included in block 1, and neuroticism, extraversion and morningness in block 2. Insomnia, as measured by the Bergen Insomnia Scale, was set as the dependent variable. Neuroticism was positively predictive of insomnia at T2, in accordance with previous studies, while age and morningness were negatively related, opposing what have been found earlier. It thus seems that some personality variables can predict insomnia among shift workers; however, more longitudinal studies with larger samples should be conducted to validate the results.

Introduction

Shift work can be defined as the arrangement of working hours that differ from the normal diurnal work period (Costa, 2003), so that "...different persons or teams work in succession to cover more than the usual 8 h day, up to and including the whole 24 h." (Costa, 2003b, p. 84). A night shift involves working from 10 p.m. to 6 a.m. (Åkerstedt, 1998). In the health sector, one out of every three employees work shift, while in the hotels, restaurants, manufacturing and transportation sector, one out of every fourth employee work shifts (Parent-Thirion, Macías, Hurley, & Vermeulen, 2005).

This type of work can have adverse effects on workers' health, including problems with gastrointestinal (colitis, gastroduodenitis and peptic ulcer), neuro-psychic (chronic fatigue, anxiety and depression), and cardiovascular (hypertension, ischemic heart diseases) functions (Costa, 1996). Knutsson, Hammar and Karlsson (2004) found shift work to be associated with increased mortality risk. Reduced performance due to fatigue and sleepiness may result in accidents and injuries as well (Chiu & Tsai, 2013; Monk, Folkard, & Wedderburn, 1996).

The term "shift work tolerance" was first conceptualized by Andlauer and colleagues in 1979 (Andlauer, Reinberg, Fourné, Battle & Duverneuil, 1979). As listed by Reinberg and Ashkenazi (2008), the traditional criteria used for shift work intolerance are symptoms of persisting fatigue and sleep alterations, regular use of sleep-inducing medications, changes in behavior and digestive problems. Tamagawa, Lobb & Booth (2007) states that "the notion of a global criterion for shift work tolerance is too simplistic" (p. 640), and that tolerance consists of many dimensions. They write that rotating shift tolerance is based on somatic health, flexibility and fatigue, while night shift tolerance consists of the variables somatic health, sleep, sleep need and flexibility (Tamagawa et al., 2007).

Åkerstedt (1998) states that disturbed sleep and wakefulness are the two most common problems related to shift work. In fact, the disturbances related to shift work can mimic those seen in clinical insomnia, and thus lead to fatigue and reduced productivity, again causing considerable economical and human costs (Åkerstedt, 1998). Shift work sleep disorder (SWSD) features symptoms of insomnia or excessive sleepiness, related to work schedule (American Academy of Sleep Medicine, 2001). Flo et al. (2012) used three questions to assess SWSD in more than 1900 nurses working either day or night shifts. They found that 44.2% of nurses working night shift had symptoms indicative of SWSD, and

28.9% of nurses working two shifts (day and evening) was symptomatic of SWSD. When applying stricter criteria, i.e. adding clinical cut-off scores of the Bergen Insomnia Scale and the Epworth Sleepiness Scale, the numbers decreased only marginally: 24.7% of two shift workers, and 38.8% of three shift workers, was symptomatic of SWSD (Flo et al., 2012). Similar numbers have been found in an American sample of shift workers (Drake, Roehrs, Richardson, Walsh & Roth, 2004).

One effect of shift work can be alterations of the circadian rhythm (Costa, 1996). The circadian rhythm produce sleep-inhibiting effects during day time, and sleep-increasing effects during the night time, which causes problems with sleeping during the day, and staying awake during the night (Åkerstedt, 2003). However, the circadian rhythm can be altered, intentionally or unintentionally: exposure to light before the core body temperature reaches nadir can cause a circadian phase delay, while light exposure after nadir can cause an advance (Bjorvatn & Pallesen, 2009). Thus it is easily imaginable how shift work, and especially night shifts, can affect ones circadian rhythm. Burgess and Eastman (2004) found that staying up late usually involves a circadian phase delay, while Dumont, Benhaberou-Brun & Paquet (2001) found some nurses to adapt to night work via a circadian phase delay, some by a phase advance, while some (“nonshifters”) did not alter their rhythms. An extensive review by Sack et al. (2007) supports this. Reinberg & Ashkenazi (2008) elegantly showed how, in a selection of male industrial shift workers (N=48, shifts rotating either every 2-4 days or every 7 days), those with low tolerance to shift work commonly had a desynchronized circadian rhythm, while those with good tolerance, or those with poor tolerance that had quit working shifts, commonly had not. “Low tolerance” was identified as having medical complaints for at least one year in the domains of fatigue, altered sleep, using sleep-inducing medication, behavioral changes and digestive problems; tolerant workers had no such complaints (Reinberg & Ashkenazi, 2008).

Several studies have found sleep-related problems and insomnia among shift workers (e.g., Chiu & Tsai, 2013; Eldevik, Flo, Moen, Pallesen, & Bjorvatn, 2013; Swanson, Aarnedt, Rosekind, Belenky, Balkin, & Drake, 2011). Insomnia can be defined as a dissatisfaction with sleep quality, combined with problems of initiating or maintaining sleep, or waking up early three nights per week or more, which causes clinically significant distress over a period of three months (American Psychiatric Association, 2013).

In their prospective study, Storemark, Fossum, Bjorvatn, Moen, Flo & Pallesen (2013)

investigated whether personality characteristics could account for sleep-related problems among different shifts. They studied 700 Norwegian nurses on a three-shift rotation schedule (day, evening, night). In total, personality variables accounted for 16,2%, 12,2% and 20,7% of the variance in sleep-related tolerance to working day shift, evening shift and night shift, respectively. Thus, personality traits can be seen as an important indicator of an individual's sleep related shift work tolerance. Costa (2003) lists this as an important aspect of tolerance to shift work. Saksvik, Bjorvatn, Hetland, Sandal and Pallesen (2011) lists young age, low scores on morningness, languidity and neuroticism, along with high scores on flexibility, internal locus of control and extraversion as individual differences connected to a higher tolerance to shift work as a whole, and young age, low scores on morningness and high scores on flexibility specifically related to the sleep aspect of tolerance.

To summarize, it seems that personality variables can affect shift workers' sleep patterns. The focus of this article will be of the personality variables of the Big Five as well as resistance to change, morningness/eveningness, and age and gender, and how these relate to insomnia symptoms in shift workers. These variables will now be discussed.

Age

Many studies have looked at the correlation between age and shift work tolerance (Saksvik et al., 2011). Some inconsistencies can be found on the topic; for instance, Bonnefond et al. (2006) found that older age was related to more performance lapses and decline in work performance, but that the younger employees reported more subjective sleepiness among a sample of male aircraft maintenance workers in a three-shift system, while Saksvik-Lehouillier et al. found that age is positively correlated to sleepiness cross-sectionally (Saksvik-Lehouillier et al., 2013) and longitudinally (Saksvik-Lehouillier et al., 2012) in a sample of Norwegian nurses on a three shift rotation. A recent study (Juda, Vetter & Roenneberg, 2013) found older age to be related to shorter and more disturbed sleep among shift workers. The common finding is that younger age is related to better tolerance, with some studies concluding otherwise (Saksvik et al., 2011). When reaching 45 – 50 years of age, an individual's tolerance to shift work will decline (Tankova et al., 1993; Costa and Di Milia, 2008).

Gender

When reviewing gender's effect on tolerance to shift work, Härmä (1993) reported no differences; as is true for Nachreiner's review (1998). Saksvik et al. (2011), using newer studies, found that four studies report more sleep related problems among women than men; including problems falling asleep and shorter sleep duration, and they conclude that men have better tolerance to shift work than women.

Personality traits

Personality traits can be defined as an internal disposition that “gives rise to habits, attitudes, skills, beliefs and other internal dispositions” (McCrae, 2001, pp. 819). These traits are stable over time, genetically contingent, and universal. Also, they interact with culture to shape people's lives (McCrae, 2001). Personality traits have been found to be stable over a 45 year period (Soldz & Vaillant, 1999). One theory seeking to explain personality with different traits is the “Big Five”, presented by McCrae & Costa (1987). It is a comprehensive, universal taxonomy, postulating that five different factors can account for personality as a whole (McCrae & Costa, 1997). The five traits are neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness (McCrae & Costa 1987).

Neuroticism.

Individuals scoring high on neuroticism can be thought of as inclined towards negative emotionality – that is, experiencing negative states as depression, anxiety, anger and embarrassment. Moreover, the trait is associated with adjectives like “self conscious”, “insecure” and “worrying” (McCrae & Costa, 1987). This trait is related to insomnia (van de Laar, 2010). McLaughlin, Bowman, Bradley & Mistlberger (2008) found neuroticism to be a strong and consistent predictor of sleep disturbance and complaints about physical and psychological well-being among airport employees in a two shift (12h) rotation. Parkes (2002), studying negative affectivity among on- and offshore workers in a 12 hour, two shift rotation (day and night), found this factor to be significantly and negatively related to perceived sleep quality (however, no relation was found between negative affectivity and sleep duration). Another study found that police officers reporting high levels of trait anxiety, repressive emotional style and negative mood, along with low levels of positive mood, had troubles with somatic health and sleep when working night shifts, and with fatigue when working rotating shifts (Tamagawa et al., 2007). The police officers were working a five-

week shift roster with seven consecutive nights, five days off, then six days alternating between early morning and afternoon shifts, then two days off, then three days of either morning or afternoon work followed by two days off, for two weeks. Hennig, Kieferdorf, Moritz, Huwe & Netter (1998) studied the biological rhythms of nurses alternating between early shift and night shift. The biological rhythm was measured by cortisol level, and through this the authors were able to discern between “adapters” and “non-adapters”. After the fifth night of working shift, the cortisol levels adapted to the work rhythm in the former group, but not the latter. Interestingly, the non-adapters had personality patterns related to neuroticism, and also reduced sleep duration after their fourth night of shift work (Hennig et al., 1998). In a large study with two population-based samples (one from Australia, one from Finland, $N > 1000$ in both), the associations between personality traits, measured by NEO-FFI, and sleep behavior and sleep problems, was examined. The results showed that higher neuroticism was related to reduced sleep quality, as measured by Jenkins' scale, and total amount of sleep: an increase of 1 SD of neuroticism increased the likelihood of gaining a higher score on sleep problems by 65% (Hintsanen et al., 2014). When studying personality directly related to insomnia, insomniacs generally score high on neuroticism, internalization and traits related to perfection (van de Laar, 2010). However, the van de Laar-review also discusses that personality tests are affected by states as well as traits, and that high scores might reflect physiological arousal and emotional distress, due to insomnia. Harvey, Gehrman & Espie (2014) have reviewed different factors related to insomnia, and presents a model on how individuals are predisposed. Specifically, they state that sleep quality is influenced by genetics, and especially sleep reactivity to stress, and that neuroticism, along with emotion focused coping, is associated with an increased stress response. This combines to give an increase in stress-reactivity, which can be a predisposing factor to insomnia, as well as hyperarousal, which can be seen as a perpetuating factor (Harvey et al., 2014).

Extraversion, Agreeableness, Openness and Conscientiousness.

Extraversion is a trait defined by sociability and joy found in the company of other people at its core (McCrae & Costa, 1987). In the Hintsanen et al. study (2014), high extraversion was associated with less sleep problems and less sleep deficiency (measured by actual sleep subtracted from self-percieved need for sleep), and thus seems to be connected with sleep problems. Nachreiner (1998) reviews that extraversion shows “low and inconsistent correlations with shift work tolerance” (Nachreiner, 1998, p. 36), while Saksvik

et al. (2011) states that extraversion is positively related to tolerance.

Agreeableness has been related to longer sleep duration, and it has been stated that “agreeableness seemed to be a trait related to good and sufficient sleep” (Hintsanen et al., 2014, p. 1220). In the same study conscientiousness was related to reduced sleep deficiency in one of the cohorts (although not in the final model of the study), and less sleep problems. Openness was found to be unrelated to sleep-problems.(Hintsanen et al., 2014). The reviews cited in this paper have not found much research done on the relationship between extraversion, agreeableness, conscientiousness and openness on the one hand, and insomnia on the other (Härmä, 1993; Nachreiner, 1998; Saksvik et al., 2011).

Morningness.

One of the most studied rhythmic phenomena to be found in humans is the circadian rhythm. This hypothalamic-generated rhythm can vary from 25 to 33 hours, but usually lasts for 24 hours in normal conditions, due to environmental factors (Tankova, Adan, & Buela-Casal, 1994). In relation to circadian rhythms, two personality types have been identified: the morning type (“lark”), and the evening type (“owl”). The former is considered to be conscientious, emotionally stable and trustworthy, while the latter gets up early with difficulty, is tired after doing so, and stays up late (Cavallera & Giudici, 2008). The larks will be most alert in the first part of the day, prefer daytime activities and have a hard time sleeping late, while the opposite is true for the owls. Evening types are found to be more flexible (Natale, Martoni & Cicogna, 2003). A study found that hereditary factors explain 45% of the variance in morningness-eveningness type (Hur, 2007); however, this leaves 55% of the variance to be explained by environmental factors, such as age, gender, and culture (Randler, 2008). A common finding is that older individuals are more morning active, and tend towards more morningness, than younger individuals (Torvall & Åkerstedt, 1980; Tankova et al., 1994). Air traffic controllers in a three shift rotation that are evening types are found to be more flexible (Natale, Martoni & Cicogna, 2003).

Some review studies have covered the subject of morningness-eveningness and shift work. Tankova et al. (1994) concludes that morning types suffer more from working shifts than evening types do: they have shorter sleep durations and less flexibility in their sleep time. Nachreiner reviewed the subject in 1998, and, whilst reporting low and inconsistent correlations, he concludes that diurnal type has no predictive power over tolerance to shift work. From 1995 to 2006, not much research was done on the topic (Cavallera & Giudici,

2008). However, in 2011, Saksvik et al. published a review, studying tolerance to shift work, subsuming the research done since Nachreiner's review. Here it is stated that being more of an evening type is related to better SWT in general, but also specifically related to sleep. In concordance with the Tankova-review, they found that being more of a morning type is related to less flexibility when it comes to sleeping, and reduced quality of sleep.

However, some studies report differently. Natvik et al. (2011), looking at 1505 nurses working two or three shifts, found a significant negative association between morningness and insomnia. Another study (Saksvik-Lehouillier et al., 2012) found a negative correlation between morningness and sleepiness, fatigue and anxiety. However, when applying a longitudinal design and controlling for the same variables at the first time of measurement, the results turned out insignificant, and they thus concluded that morningness cannot predict SWT. Saksvik-Lehouillier et al. (2013) compared nurses new to working night shifts with experienced night shift nurses, and found that morningness was positively related to shift work tolerance in the former group. When controlling for different shifts, those on a three shift rotation identified as being more evening type experience more sleep constraint, shorter sleep durations, reduced sleep quality and higher social jet lag after working a morning shift, while the same is true for morning types working night shift (Juda, Vetter, & Roenneberg, 2013). Storemark et al. (2013) found the same association between morningness and sleep-related day shift tolerance, but no such relationship was found between eveningness and sleep-related night tolerance.

Some studies have also tried to discover if some of the personality traits of the Big Five-model are directly linked to the morningness-eveningness dimension. One such study is Randler (2008), which found significant positive associations between morningness and agreeableness, and morningness and conscientiousness, while neuroticism was related to eveningness, in a selection of school pupils and university students (Randler, 2008). In the same vein, Tsaousis (2010) conducted a meta-analysis, subsuming 8589 individuals (not shift workers). Here it was found that conscientiousness was the factor that to the highest degree could explain the variance in morningness. Agreeableness was also significantly associated with morningness, but to a much lesser degree. Only minor correlations were found between morningness and extraversion and neuroticism. The importance in statistically controlling the different variables, such as to avoid variables strongly related confounding the results, have been pointed out by Bohle (1997).

Resistance to change.

Resistance to change can be seen as an individual's inclination towards devaluing and resisting change, and find it aversive (Oreg, 2003). It is suggested that this measure can be used in selecting employees for jobs that entail frequent changes. As working different shifts can be seen as frequent change, this can be an important factor in measuring shift work tolerance. Resistance to change is correlated with neuroticism and some facets of extraversion (routine seeking and short-term focus) (Oreg, 2003). Thus, one can hypothesize that resistance to change will also be related to sleep-related shift work tolerance – or at least, it should be controlled for (Bohle, 1997). As far as the knowledge of the author of this paper goes, no studies examining the relationship between resistance to change and sleep-related shift work intolerance, have been conducted.

The predictive power of personality

Reviewing literature on shift work tolerance from 1993 to 1998, examining neuroticism, extraversion, and morningness/eveningness (among other variables), Nachreiner (1998) concludes that individual variables have no predictive power when it comes to determining tolerance/intolerance, albeit they somewhat consistently show covariation. The Saksvik et al. (2011) review reported earlier, picked up Nachreiner's thread and examined literature from 1998 up until 2009. Finding somewhat similar patterns, they report a bit more optimistically that “some individual factors are consistently related to shift work tolerance” (Saksvik et al., 2011, p. 231). Also here it is concluded that prediction is not possible; however, this is due to the dearth of longitudinal studies. This is in concordance with Härmä's review from 1993, who also commented the lacking ability of individual differences to predict tolerance to shift work. It thus seems just to conclude that, to be able to predict who will show symptoms of insomnia (or not) as a consequence of shift work, longitudinal studies are required. Except the Saksvik-Lehouillier et al.-study from 2012, not one single longitudinal study has been published that has examined the relationship between personality and insomnia, to the knowledge of the author of this paper. It is also worth noting that most of the previously published studies examine SWT as a whole; not many studies look at insomnia symptoms specifically. Considering the consequences of sleep troubles as a result of shift work, and the effects these symptoms have on those suffering from them, the goal of this paper is to find out whether symptoms of insomnia can be predicted on the basis of different personality traits, or not. In a study by Hanson, Åkerstedt, Näswall, Leineweber, Theorell &

Westerlund (2011), it was shown how there exists reciprocal and reverse relationships between workplace variables on the one hand and sleep disturbances and awakening problems on the other when measured over a two-year time lag; this shows the importance of cross-lagged analyses in longitudinal studies.

The present study

Based on previous research, it is reasonable to expect age, morningness, neuroticism and extraversion to relate to insomnia among shift workers. More specifically, based on the majority of results, age is hypothesized to be positively associated with insomnia symptoms. Regarding morningness, the field reports varying results. Natvig et al. (2011) found a negative relationship between morningness and insomnia, and argue that this might be caused by a stronger circadian phase disruption among subjects who are more disposed towards eveningness. Reviews report inconsistent results, while some studies report a positive relationship. Seeing that Natvig et al.'s study is most similar to the current one in design, and focuses specifically on insomnia symptoms, one would expect to find results in line with theirs, ie. a negative relationship between morningness and insomnia symptoms. Regarding neuroticism, the field is more in agreement – most studies and reviews report a positive relationship, albeit somewhat inconsistently. In line with this, a positive relationship is expected to be found in this study. Extraversion is, even less consistently, related negatively to insomnia symptoms. Regarding the last three of the Big Five traits – agreeableness, openness and conscientiousness – relationships are usually non-existent or elusive at best. Thus, associations would not be expected. Resistance to change, is not known to relate to insomnia. However, due to the trait's similarities with neuroticism, along with negative correlations with extraversion, one would expect it to be positively predictive of insomnia. This gives the following hypotheses:

H1: Neuroticism at T1 will positively predict insomnia symptoms among shift workers at T2.

H2: Extraversion at T1 will negatively predict insomnia symptoms among shift workers at T2.

H3: Agreeableness, Openness, and Conscientiousness at T1 is not related to insomnia symptoms among shift workers at T2.

H4: Morningness at T1 will negatively predict insomnia symptoms among shift workers at

T2.

H5: Resistance to change at T1 will positively predict insomnia symptoms among shift workers at T2.

H6: Age at T1 will positively predict an increase in insomnia symptoms among shift workers at T2.

Methods

Sample

The sample consists of employees of a municipality in Norway, employed in different types of shift work. A total of 1106 recipients received a questionnaire. Sixty-five e-mails were returned due to incorrect addresses, thus 1041 employees received the e-mail. Of these, 327 answered the whole or parts of the survey, giving a response rate of 31.4%. For the first round, $N=327$. Of these, 79% worked in the health sector (nurse, nursing assistant, ect.; $n=68$), 15% worked with pedagogy, children and youth (social worker, child welfare, etc.; $n=13$), and 6% ($n=5$) worked fell outside of those categories. In total 72% ($n=62$) of respondents were female, 28% ($n=24$) were male. The youngest participant was 20 years old; the oldest 65 years (mean=37, st.d.=11). Regarding responsibility for own children, 52% of workers was not responsible for own children; 32.6% had full responsibility for children, while 14% had some responsibility for children (one person failed to give this information). The distribution of different shift schedules looked like this: 2.3% of employees ($n=2$) worked only evening shifts, 54.7% worked only night shifts ($n=47$), 29.1% worked rotating shifts (day, evening, night; $n=25$), and 14% worked day and evening shifts ($n=12$).

Procedure

The survey was sent via e-mail twice: once in January, 2013, and once in June/July, 2013. It was available three weeks every time, and two reminders were sent via e-mail to those who did not respond initially. The survey was electronic, and respondents were forwarded to it by clicking a link in the e-mail. Also included in the e-mail was information about the survey being voluntary and anonymous. In the first round, an e-mail with a link to the survey was sent to a list containing all employees in Trondheim commune that sometimes, through to always, work night shifts To be able to discern those that had responded to both questionnaires, and yet retain anonymity, respondents were asked to include the last five digits of their phone number. In the second round, 96 of the 327

participants that completed the survey the first round, responded. This gives a response rate of 29.4%. Of those responding to both rounds, 10 were working only day shifts, and were excluded from the analyses. Sample size was reduced in the analyses as a function of the response rate on the different variables.

Ethics

A question as to whether the project needed approval was sent to REK (Regional Committee of the Medical and Health Sciences Research Ethics) and NSD (Norwegian Computer services of the Social Sciences). The project did not need approval of REK, and it was approved by NSD.

Instruments

Along with demographic questions (age, gender, shift type, responsibility for children at home), the Diurnal Type scale, the Mini-IPIP and the Resistance to Change-scale are included as measures of personality traits. For measuring insomnia, the Bergen Insomnia Scale was used.

The diurnal type scale was constructed in 1980 by Torsvall and Åkerstedt as a short measurement of subjects' tendency towards morningness or eveningness (Torsvall & Åkerstedt, 1980). Through seven questions, the survey measures sleep/wake behaviour and -preferences. Examples of questions are «When would you prefer to rise (provided you have a full day's work – 8 h) if you were totally free to arrange your time?» with four optional answers: «before 0630», «0630-0729», «0730-0829», and «0830 or later»; “If you always had to rise at 0600, what do you think it would be like?”, with answers ranging from “very difficult and unpleasant”, “rather difficult and unpleasant”, “a little unpleasant but no great problem”, and “easy – no problem at all”; and “Please, indicate to what extent you are a morning or evening individual!”, with the possible answers “pronounced morning active (ie, morning alert and evening tired)”, “to some extent morning active”, “to some extent evening active (ie, morning tired and evening alert)”, or “pronounced evening active”. Each answer has a numeric score ranging from 1 to 4. Higher scores indicate morningness, while low scores indicate a disposition towards eveningness. The index has high internal reliability and consistency (Torsvall & Åkerstedt, 1980).

The Mini-International Personality Item Pool (MINI-IPIP henceforth) is a short form, created with the purpose of measuring the Big Five personality traits – Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Intellect/Imagination (Donnellan,

Oswald, Baird & Lucas, 2006). The 20 questions included was selected from the 50-item IPIP-FFM through factor analysis; four questions measuring each trait, each question answered by deciding on a 5-point Likert scale how descriptive each statement is for the respondent. Examples of statements from the questionnaire is “Am the life of the party.” (Extraversion), “Get upset easily.” (Neuroticism), and “Like order.” (Conscientiousness). All statements are rated on a five point Likert-scale (1 = strongly disagree, 5 = strongly agree). The MINI-IPIP has good content validity, equaling that of other measures of the Big Five; good convergent validity with The Big Five Inventory ($r = .81, .49, .66, .80, .68$ for Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness with Intellect/Imagination, respectively); high short term and long term test-retest correlations, and high internal consistency across five studies (Donnellan et al., 2006).

The Resistance to change scale was designed by Oreg (2003) to measure individuals inclination towards resisting change, and splits this disposition in four facets: routine seeking, emotional reaction to imposed change, short-term focus, and cognitive rigidity. Examples of questions in the scale is “I generally consider changes to be a negative thing” (Routine seeking), “I sometimes find myself avoiding changes that I know will be good for me” (Short-term focus), and “I often change my mind” (Cognitive rigidity). The scale contains 17 statements, each rated on a six-point Likert scale, ranging from 1 – Strongly disagree to 6 – Strongly agree. The Resistance to change scale has high internal consistency across studies, and it is predictive of voluntary change, resistance to innovation and reactions to imposed change (Oreg, 2003).

The Bergen Insomnia Scale was constructed with the purpose of measuring insomnia, based on formal and clinical diagnostic criteria (Pallesen, Bjorvatn, Nordhus, Sivertsen, Hjørnevik, & Morin, 2008). The scale consists of six items, three of which pertain to three types of insomnia: sleep onset, maintenance and waking up early. The last three of which regards not feeling rested, daytime impairment and not being satisfied with the sleep. Scores range from 0 to 7, indicating how many days a week a symptom has been experienced. This gives possible total scores ranging from 0 to 42. The scale discriminates well between students and community members on the one side, and patients from a sleep clinic on the other. The BIS has high correlations with other measures of sleep and sleep quality (Pallesen et al., 2008).

Statistical analysis

All statistical analyses were performed using the statistical program IBM SPSS, version 21. A Pearson product-moment correlation coefficient was computed with all relevant variables (age, gender, shift type, children at home, the Big Five traits, resistance to change, morningness and insomnia) at T1, to examine correlations between the different variables. Only variables significantly correlated to insomnia here were included in further analysis.

The main analysis, exploring relationships between personality variables at T1 and insomnia at T2, was computed using a hierarchical multiple regression analysis. Insomnia score at T2 was set as the dependent variable. In block 1, age, gender, children at home and shift type was included. In block 2, the three variables found to correlate with insomnia (extraversion, introversion, morningness-eveningness) were included.

A cross-lag hierarchical multiple regression analysis was executed to examine the directionality of the relationship between insomnia and personality. The personality variable strongest related to insomnia in the main analysis, neuroticism, was set as the dependent variable, with the control variables in block 1, and insomnia at T1 in block 2.

Results

Preliminary correlational analysis showed negative relationships between insomnia and morningness ($r=-.33, p<.001$) and extraversion ($r=-.13, p<.05$), and a positive relationship between insomnia and neuroticism ($r=.34, p<.001$). The results are summarized in table 1.

The assumptions of the hierarchical regression analysis, in terms of normality, linearity, multicollinearity, independence of residuals and homoscedasticity, were investigated. No major violations were found. According to criteria set by Tabachnick & Fidell (2013), two outliers were identified (standardized residual $> 3,29$). As this study had a relatively small N , the outliers should be removed (Tabachnick & Fidell, 2013). The removal of the cases yielded somewhat different results compared to the first analysis, and the final analysis was kept.

Model 1, including the variables age, gender, shift type and children at home, accounted for 15.7% of the variance in insomnia score at T2, $F(4, 66)=3,06, p=<0.05$. When including extraversion, neuroticism and morningness (model 2), the model explained 31.7%

of the variance in insomnia at T2, $F(3, 63)=4.94, p<0.01$. In the final model, age ($\beta =-.36, p < .01$) and morningness ($\beta =-.28, p<.05$) were negatively related to insomnia symptoms at T2, while neuroticism ($\beta =.30, p<.05$) was positively related to insomnia at T2. The results are presented in table 2.

In the cross-lag analysis, examining if neuroticism score was affected by neuroticism score or the other control variables, only the variable “Gender” was significantly (negatively) related to neuroticism score. Insomnia at T1 was not significantly related to Neuroticism at T2. The results are presented in table 3.

Discussion

Past research have established relationships between the variables morningness, neuroticism, age and extraversion, and insomnia among shift workers. Consistency and predictive power have, however, been scarce. This study aimed to investigate if personality variables could predict insomnia among shift workers over a six month time span. After controlling for demographic variables, small but significant associations were found between different personality variables at T1 and insomnia symptoms at T2. Specifically, neuroticism was positively related to insomnia symptoms, supporting hypothesis one. Extraversion was found to be unrelated, leaving hypothesis two unsupported. No relationships were found between agreeableness, openness and conscientiousness, hence, hypothesis three was supported. Morningness was negatively associated, thus supporting hypothesis four. Resistance to change was found to be unrelated, leaving hypothesis five unsupported. Age was negatively associated with insomnia, which is in contradiction to hypothesis six. All in all, this confirms the notion that personality can predict sleep related tolerance to shift work. However, as the final model only accounted for just above 30% of the variance, a lot is explained by other variables not covered in this study.

Neuroticism

Neuroticism was found to be predictive of insomnia symptoms, which is according to hypothesis one. Thus, shift workers high in neuroticism can be expected to also show insomnia symptoms. Both reviews (Nachreiner, 1998; Saksvik et al., 2011) and studies (e.g. McLaughlin et al., 2008; Parkes, 2002; Tamagawa et al., 2007) find similar patterns. Saksvik et al. argues that the three correlational studies they examined “seems to apply thorough and reasonable measures of shift work tolerance, which add to the quality of the studies” (Saksvik

et al., 2011, p. 23). One explanation to the relationship between neuroticism and insomnia might be that those with a high score on the trait in general are ready to complain more than others, as argued by Hennig et al. (1998). This would yield a higher neuroticism score. In a similar vein it has been argued by van de Laar (2010) that the detrimental effects of suffering from insomnia affect one's daily functioning and, henceforth, how one responds on the survey. To control for this, future studies should ideally control for personality variables already before employees start working shifts. However, it does not seem intuitive that such a factor could explain the whole relationship commonly found.

A more sound explanation is found in Harvey et al.'s model (2014), where those high in neuroticism are prone to increased stress-reactivity and negative affect. Through the first episode of sleep disruption, an implicit associative learning occurs, whereby sleep and sleep environment gets associated with negative emotion. An explanation as to why not all who score high on neuroticism show insomnia symptoms, can be found in the genetic pathway modulated by the 5HTTLPR serotonin transporter polymorphism (Harvey et al., 2014). This polymorphism may both lead to a direct increase in physiological stress response, which again may lead to disturbed sleep, and it may interact with personality (so that those prone to experiencing negative affect cope with this by focusing on the negative emotion, which increase the number of stressful episodes experienced). Thus, neuroticism in itself may not solely be responsible for insomnia, but combined with predisposing genetics it may lead to disrupted sleep (Harvey et al., 2014). Van de Laar (2010) argues that people with insomnia generally show signs of neuroticism, and tend towards perfection, anxiety and internalization of negative emotions. It is argued that this could lead to a state of constant arousal; this is quite similar (albeit a bit simplified) to what Harvey et al. suggests. Hennig et al. (1998) found that shift workers whose circadian rhythm, as measured by cortisol secretion, did not adapt to shift work schedule, also had high scores on traits similar to neuroticism. This can be combined with Reinberg & Ashkenazi's (2008) finding that people experiencing sleep alterations as a consequence of shift work have desynchronized circadian rhythms; neuroticism might predispose for this. It should be caveated that Hennig et al.'s (1998) study had a rather small n, and they justly are cautious in their interpretations. Their study is, however, a replication of their findings from a previous pilot study (Hennig, Moritz, Kieferdorf, & Netter, 1994).

A study conducted in a large, population-based sample (Hintsanen et al., 2014) found

neuroticism to be linked to reduced quality and amount of sleep, but it only explained 2-3% of the variance. When considering neuroticism as a predisposing factor, and shift work a perpetuating factor, it seems logical to find higher variance explained in a shift working sample, which was the case in the current study.

The cross-lag analysis, testing the predictive power of insomnia symptoms over neuroticism, yielded no significant results. It is thus safe to say that neuroticism to a degree predicts insomnia symptoms, whilst insomnia does not cause neuroticism. As argued by McCrae (2001), personality interacts with the environment to shape behavior; however, the underlying traits are stable despite major intervening life events, and would remain unchanged. In line with this is the 45-year long longitudinal study of Soldz and Vaillant (1999), which showed that traits remained stable. This finding supports the notion that personality traits are not easily changed. Härmä (1993) argued that shift work can induce personality changes, and that neuroticism is a result of shift work; in the light of the current results, this does not seem to be the case.

Extraversion, Agreeableness, Openness, Conscientiousness and Resistance to Change

Hypothesis two, that extraversion would correlate negatively with insomnia symptoms, was only partially supported, in that the preliminary analysis showed correlations, but not the final analysis. From these results it is not possible to predict insomnia as a consequence of extraversion, and the relationship found was fairly weak. The lack of predictive power is in line with reviews on the subject (Härmä, 1993; Nachreiner, 1998; Saksvik et al., 2011), however, stronger correlations might have been expected.

Regarding the remaining personality traits, ie. agreeableness, openness, conscientiousness and resistance to change, they were not found to correlate with insomnia in the preliminary correlation analysis. Based on this, along with the traits' lack of significance in predicting insomnia in the literature, and a wish to maintain as good a N-to-independent-variable ratio as possible ($N \geq 50 + 8m$, where m = number of independent variables; Tabachnick & Fidell, 2013), they were excluded from the final analysis. A goal of a hierarchical regression analysis should be to include as small as possible a set of independent variables that correlate with the dependent variable, but not each other, so that independent facets of the variability in the dependent variable can be explained (Tabachnick & Fidell, 2013).

Considering the abovementioned arguments, hypothesis three can be considered partially supported. It is worth controlling for such variables, even if one does not expect a relationship to be found, to avoid confounding (Bohle, 1997). Hypothesis five was not supported, as resistance to change was found to be unrelated to insomnia symptoms.

Morningness

Morningness was found to be negatively related to insomnia symptoms in the preliminary correlational analysis, and negatively predictive of insomnia in the hierarchical regression study, supporting hypothesis four. This translates to morning larks having less insomnia symptoms than night owls, which is as hypothesized. Also, it is in agreement with findings from Natvig et al. (2011) and the correlational analysis conducted by Saksvik-Lehouillier et al. (2012), with the current study showing a higher beta than the two previous ones. The former study found morningness to be negatively associated with insomnia symptoms, while the latter found morningness to be negatively correlated with sleepiness (as well as fatigue and anxiety). The two mentioned studies are methodological sound with large sample sizes ($N > 1000$). However, in the Saksvik-Lehouillier et al.-study (2012), the researchers failed to find predictive power when analyzing their longitudinal data.

Some studies (Juda et al., 2013; Storemark et al., 2013) have found morningness to be positively associated to sleep related tolerance; however, this has been found when studying tolerance to specific shift types – evening types experiencing sleep constraint on morning-shift days, and morning types experiencing sleep constraint on evening-shift days. Saksvik-Lehouillier (2013) found that morningness was positively related to tolerance to shift work, but only among those nurses that were new to shift work. They argued that this relationship might be due to the new nurses working more morning shifts, making a disposition towards morningness preferable. In the current study more than half of the participants work only night shifts. Accordingly, a disposition towards eveningness would be hypothesized as beneficial. However, considering the negative relationship between morningness and insomnia in this sample, this is not the case, and an explanation must be sought elsewhere.

This might be a result of the relationship between morningness and conscientiousness. High scores on morningness have previously been linked to high scores on conscientiousness (Randler, 2008; Tsaousis, 2010), and a positive relationship between the two was also found in the correlation analysis of the current study. Higher conscientiousness is associated with

better sleep in terms of quality and amount and less sleep problems (Hintsanen et al., 2014; Randler, 2008). Conscientiousness people are best described as structured, hard-working and directed (McCrae & Costa, 1987). It thus might be that those low in morningness also lack the conscientiousness that enables them to structure their day sufficiently so as to get enough sleep in between shifts. Those high in morningness, albeit having an sub-optimal circadian rhythm, might have the required personality trait to compensate for this. However, opposing this, is the fact that a relationship was not seen between conscientiousness and insomnia in the current study.

A moot point in the Saksvik et al.-review (2011) is whether or not the morningness-eveningness dimension reflects a true and stable personality trait or not; according to them, the literature is inconclusive. They also point out that most people are neither of the extremes, but somewhere in between. Reinberg & Ashkenazi argues that differences in insomnia symptoms can be explained by a desynchronization of the circadian rhythm; those unable to synchronize to the shift type, would display more symptoms (Reinberg & Ashkenazi, 2008). Thus, even if one would describe oneself as a “morning type”, it is possible that the circadian rhythm adapts to evening- or night work in some people, while not in others (Dumont et al., 2001). As Bjorvatn & Pallesen (2009) argues, SWD can be treated with both bright light and melatonin. However, this would rely on a malleable circadian rhythm, and would presumably not work on those individuals whose circadian rhythm does not adjust to the shift work. This would give that what affects insomnia symptoms is not the tendency towards morningness or eveningness in itself, but the propensity towards adaptation of the circadian rhythm or not. Evidence that supports the notion of circadian rhythms being malleable in some individuals abound (Burgess and Eastman, 2004; Dumont et al., 2001; Reinberg & Ashkenazi, 2008). For further studies, adaptability of circadian rhythm might be a more fruitful personality trait to measure than the morningness score in itself. It is worth noting that this the tendency towards malleability of the circadian rhythm could still be considered a personality trait, as long as the degree of adaptability remains stable, according to the definition set by McCrae (2001). More than half of the current sample work night shifts, which is associated with a circadian phase delay (Burgess and Eastman, 2004). This delay is in turn is smaller among morning types (than in evening types) (Dumont et al., 2001). Natvig et al. (2011) argues that because of this, three shift workers that are not morning types will experience a stronger disruption of their circadian rhythm. In this an explanation might be found as to why a high morningness score

is related to less insomnia symptoms in the current sample.

It has previously been reported that morningness cannot predict sleepiness (e.g. Härmä, 1993; Nachreiner, 1998; Saksvik et al., 2011). This conclusion need not be based on the existing evidence, but rather on a lack thereof, considering the seemingly few longitudinal studies that have been conducted in the time span from 1993 until 2014. Researchers studying the topic have frequently requested more longitudinal studies to justify conclusions (e.g. Natvig et al., 2011; Saksvik-Lehouillier et al. 2012; Storemark et al., 2013). Thus, the current study, along with recent research, can be among the first few that indicate how morningness, in fact, might predict degrees of insomnia among shift workers. The participants in the study were largely working night shifts only, which makes for a homogenous group. Inferences can thus more justly be made than had the group consisted of equally sized, very different groups. However, considering the small *N* of the study, rather than paradigm-shifting, the findings might be interpreted as indicative of the scope future studies might have.

Noteworthy is also the fact that the reviews cited here (Härmä, 1993; Nachreiner, 1998; Saksvik et al., 2011) mostly look at tolerance to shift work as a whole, and not sleep related problems specifically.

Age

Age was hypothesized to be positively predictive of insomnia symptoms (hypothesis six); however, the opposite was found, giving that older age predicts less insomnia symptoms. This is in contrast to what one would expect after reading reviews (Nachreiner, 1998; Saksvik et al., 2011) and recent research, showing that with older age comes problems falling asleep, waking early, and amount of sleep (e.g. McLaughlin et al., 2008; Natvig et al., 2011; Saksvik-Lehouillier, 2012). One reason for the contradictory results in this study might be found in the shift towards less tolerance to shift work that commonly incurs after 45-50 years of age (Costa & Di Milia, 2008; Tankova et al., 1993). In this article's final sample, the mean age was 38.5 years; it is thus possible that the sample is too young to include the recession in tolerance that can be seen in older individuals. Another explanation is found in the “healthy shift worker effect”; the finding that the older workers that remain in shift work are those more tolerant to it (Knutsson, 2004). Thus it is possible that the younger employees show more insomnia symptoms than the older ones as the latter group might be more “selected” in terms of more experience and higher tolerance.

Strengths and limitations

Some limitations of this study should be mentioned. For one, it has rather few subjects ($N=86$) in the final analysis. According to criteria (2013; $N \geq 50+8m$), for seven independent variables, n should have been 106 or greater, when relationships found are around $\beta=.20$ (Tabachnick & Fidell). The relationships found in this study are somewhat larger. However, Khamis and Kepler (2010; reference from Tabachnick & Fidell, 2013) conceptualized a new formula based on reliability ($N > 20+5m$). Tabachnick & Fidell states that this rule could be used to define a minimum sample size. Using the latter formula, one would require 55 participants for the current study; a cutoff this study is well above. Another thing to consider in this equation is the reliability of the independent variables: less reliable variables calls for more cases (Tabachnick & Fidell, 2013). The measures included in the hierarchical regression analysis have been found to be reliable (Donellan et al., 2006; Torsvall & Åkerstedt, 1980).

Response rates can be considered low, with a rate of just above 30% at T1, and close to 30% at T2. This is however similar to the rate in previous studies (e.g. Natvig et al., 2011; Saksvik-Lehouillier et al., 2012). Also, with most of respondents being female, working in the health sector, the findings can hardly be said to be descriptive of the general population. The sample is, however, descriptive of the population working in the health and pedagogy/children and youth sector in Norway, and with some caution results might be generalized to said population, or at least, populations with similar characteristics. One might also speculate that findings can be applied to other professions with similar shift types.

Noteworthy is also the point argued previously, that all shift types are studied together. In the current study, the sample consists mostly of night workers and three shift workers. Some researchers have argued that different grades of morningness/eveningness relate to better tolerance to different shift types. However, the regression analysis showed no relationship between shift type and insomnia symptoms; also, splitting into different groups based on shift type would have yielded a rather small sample size (e.g. $n=2$ for evening shifts only). More than 50% of employees also worked night shifts alone, which give a more homogenous ground. This probably affected the results. Also, 72% of respondents were female. However, this is representative of the employment group included in the study (health sector, social workers) in Norway.

Only three personality variables were included in the final analysis, due to the sample

size and the correlations found in preliminary study (as argued above). More personality variables may be implicated in insomnia, e.g. hardiness, flexibility and languidity (Saksvik-Lehouillier et al., 2012). Furthermore, as noted by Costa (2003), both family, living and social conditions can affect ones tolerance. This study sought to control for some of the best known influential variables (age, gender, children at home), but more factors can probably play a part. This is seen in the fact that, in spite of the final model being significantly predictive of insomnia, only 31.7% of the variance was explained.

Also worth mentioning is the risk of making Type I-errors; rejecting a null hypothesis when it should be retained. In the current study, all significant results had a p -value of $<.05$, implying that there is a slight risk that the null hypothesis is rejected when it is, in fact, true. However, such a small risk (a 5 % chance) is considered acceptable by both tradition and journal editors (Tabachnick & Fidell, 2013). The probability of making Type II-errors, retaining the null hypothesis in spite of the alternative hypothesis being true, have not been calculated or taken into account in this study. This could have been done for the variables found to not relate to insomnia in the correlational analysis; however, due to most of these results being in line with what have been found in previous literature, this was not considered.

In the current study, some strengths are also worth mentioning. First of all, it is a longitudinal study, which is long sought after on the subject. Thus it adds to the field by increasing the ability to predict insomnia, rather than just examining relationships. Some might argue that six months is rather short; however, six months is, by far, better than cross-sectional studies, which seems normative for the field.

As previously mentioned, some different approaches have been used regarding types of shift: some studies consider all different shift types, while some consider specific shifts separately. What is of importance here, is that similar definitions of what shift work actually is (ie., work hours taking place outside of conventional work hours), have been applied across most studies, including the present one. By applying the Bergen Insomnia Scale as the measure for sleep problems, sleep problems as a variable have been defined in a valid and reliable way in this study (considering the BIS' validity and reliability; Pallesen et al., 2008). When defining both sleep problems and shift work the current paper is in line with what has previously been conducted in the field. The study also has been conducted using sound, valid

instruments to measure the different personality variables and insomnia. This strongly increases the study's validity. One might discuss the reliability of using questionnaire measures, as these are subjective data. However, one cannot sidestep the fact that personality might be hard to define as a purely objective measure, but rather one that should be considered subjective instead, and thus measured likewise. Also, taking in account the high validity and reliability of the measurements used (Donellan et al., 2006; Torsvall & Åkerstedt, 1980), the subjective nature of personality can be seen as controlled for.

Implications

This study yields insights into how different aspects of personality relates to, and predicts, insomnia symptoms among shift workers. Specifically, high scores on neuroticism combined with a disposition towards eveningness is predictive of insomnia symptoms. Furthermore, a theoretical predisposing genotype can be found in those subjects high in neuroticism, predisposed towards increased stress-reactivity and negative affect, along with a non-adapting circadian rhythm. Young age was also found to be predictive of insomnia symptoms; however, considering that this is in opposition to what is commonly found, this needs replication before conclusions can be drawn.

As one of very few longitudinal studies of a recent date, one should be cautious when interpreting the results. Rather than using the findings for personnel selection, which might ultimately be the goal, they should be used as a base for further studies of the same sort. Future studies should ideally have a larger sample size, while nuancing how morningness relates to the different shift types. Following subjects for a longer amount of time would also be beneficial, as to see whether insomnia symptoms remain stable over longer periods of time.

Being able to predict who is tolerant to different types of shift work would be more cost-efficient for employers in terms of reducing unwanted injuries and performance lapses. For employees, the health benefits of not working shifts when disposed to insomnia and the detrimental problems following, would be significant. The point must be, however, not to exclude people based on personality, but to make informed choices on whether or not one wishes to work on a shift that possibly can have detrimental effects on one's health, and for employers to facilitate for employees working suitable shifts.

Conclusion

Morningness negatively predicts insomnia symptoms among shift workers, while neuroticism positively predicts the same. This is in line with some research on the subject and the hypotheses. Age was found to negatively predict insomnia symptoms, which is contradictory to what was hypothesized and most literature on the subject, and should thus be replicated before further interpretations. Agreeableness, Openness, Conscientiousness and Resistance to Change was all found not to be related, according to literature and hypotheses. These results should be some of the first in a hopefully long line of longitudinal studies further unraveling the predictors of insomnia among shift workers, thus contributing to make informed choices and decisions regarding shift work.

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Table 1:

Means, standard deviations and correlations between insomnia symptoms, demographics and personality variables, measured at T1 (N = 327).

	Means (S.D)	1	2	3	4	5	6	7	8	9	10	11	12
1. Gender		-											
2. Children at home		.06	-										
3. Shift type		-.13*	.17**	-									
4. Age	38.5 (11.66)	.09	-.1	-.11	-								
5. RTC	2.92 (.62)	.03	-.05	.08	.07	-							
6. Extraversion	3.58 (.83)	-.14*	.01	-.06	-.08	-.15**	-						
7. Agreeableness	4.43 (.58)	-.23**	.02	.03	-.02	-.09	.29**	-					
8. Conscientiousness	4.1 (.68)	-.22**	-.1	-.01	.08	-.07	.12	.26**	-				
9. Neuroticism	2.8 (.84)	-.2**	-.08	-.02	-.18**	.19**	-.15*	.01	-.13*	-			
10. Openness	3.5 (.73)	.15*	.08	-.04	-.08	-.13*	.18**	.16**	-.16*	-.03	-		
11. Morningness	15.67 (3.76)	-.04	-.14*	.03	.04	-.1	-.03	-.13*	.14*	-.09	-.07	-	
12. BIS	18.96 (9.25)	-.05	-.00	-.05	-.08	.11	-.13*	.08	-.08	.34**	-.07	-.33**	-

Note: RTC = Resistance to Change; BIS = Bergen Insomnia Scale. *p < 0.05; **p < 0.01.

Table 2.
Hierarchical regression analysis for variables predicting insomnia at T2 (N = 73).

Variable	<i>B</i>	<i>SB</i>	<i>β</i>
Step 1			
Gender	1.93	2.11	0.11
Children at home	0.32	1.03	0.04
Shift type	-1.24	1.21	-0.12
Age	-0.28	0.09	-0.37**
Step 2			
Gender (1 = male, 2 = female)	2.55	2.14	0.14
Children at home (1 = yes, 2 = no)	0.17	1.00	0.02
Shift type (1 = only day shift, 2 = only evening shift, 3 = only night shift, 4 = rotating day, evening and night shift, 5 = rotating day and evening shift)	-1.34	1.14	-0.18
Age	-0.27	0.08	-0.36**
Extraversion	-0.49	1.02	-0.06
Neuroticism	2.70	1.04	0.30*
Morningness	-0.61	0.24	-0.28*

Note: Insomnia: R² step 1 = .157*; Δ R² step 2 = .161**, *p < 0.05; **p < 0.01.

Table 3.

Hierarchical regression analysis for variables predicting neuroticism at T2 (N = 68).

Variable	Insomnia symptoms		
	B	SB	β
Step 1			
Gender (1 = male, 2 = female)	-.47	.23	-.25*
Children at home (1 = yes, 2 = no)	-.03	.11	.04
Shift type (1 = only day shift, 2 = only evening shift, 3 = only night shift, 4 = rotating day, evening and night shift, 5 = rotating day and evening shift)	.04	.13	.04
Age	-.01	.01	-.14
Step 2			
Gender	-.49	.23	-.26*
Children at home	.03	.11	-.3
Shift type	.04	.13	.04
Age	-.01	.01	-.12
Insomnia score	.01	.01	.10

Note: Neuroticism: R^2 step 1 = ,095; ΔR^2 step 2 = ,009. * $p < 0.05$