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**PERSONALITY IN RELATION TO HEALTH,  
PSYCHOSOCIAL WORK ENVIRONMENT AND  
OCCUPATIONAL HEALTH INTERVENTION  
ADHERENCE**

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# Personality in relation to health, psychosocial work environment and occupational health intervention adherence

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*À ma famille. Je vous aime.*



## ABSTRACT

**Background:** Personality is a well-studied topic within psychology and it has intrigued scientists and philosophers for centuries. It is a broad, complex and multidimensional phenomenon that constitute individuals' typical behavioral patterns. One of the fields within personality psychology studies the relationships between personality, health and disease. Although the complete mechanisms have not been fully established, the associations with health and disease can be both direct or indirect through dysfunctional and unhealthy and risk-taking behaviors. Personality can also influence how health is perceived and reported. In addition, the current knowledge is mainly based on assessments of broad personality dimensions. Therefore, a better understanding of more specific and precise health-relevant personality traits could help clarify the mechanisms in more detail.

Personality has also been found to be associated with various aspects of the psychosocial work environment, such as job satisfaction, stress and work performance, but no studies have investigated health-relevant personality traits in this context. Organizations may implement interventions, such as stress management or health promotion initiatives with the best intentions. However, there is limited knowledge about which interventions work for whom and why. Therefore, there is a need to better understand the characteristics of those who do and do not utilize (adhere to) an intervention. This knowledge could be used improve pedagogic features of the interventions and implementation procedures in order to optimize adherence.

**Aim:** The overall aim of this thesis was to examine possible associations between health-relevant personality traits and indicators of health, psychosocial work environment and occupational health intervention adherence. The specific aims of the four papers included in this thesis are stated below.

*Paper I* aimed to investigate health-relevant personality in relation to one aspect of health, or ill-health, namely sensitivity to sound (hyperacusis).

*Paper II* aimed to explore possible associations and differences in mean values between employee health-relevant personality traits and assessments of the psychosocial work environment and leadership behaviors.

*Paper III* aimed to investigate possible associations between health-relevant personality traits and adherence to a web-based occupational health intervention.

*Paper IV* aimed to investigate health-relevant personality traits in relation to health-related variables and indicators of the psychosocial work environment, using repeated assessments over time. The paper also investigated if these personality traits could predict changes in perceptions of health and psychosocial work environment over time.

**Methods:** The present thesis is based on three separate studies and populations. Personality was assessed with the Health-relevant 5 inventory (HP5i) in all papers. Health-relevant

personality consist of the following five traits: Hedonic capacity (a facet of Extraversion), Negative affectivity (a facet of Neuroticism), Antagonism (a facet of Agreeableness), Impulsivity (a facet of Conscientiousness) and Alexithymia (a facet of Openness). Papers I and II had cross-sectional designs whereas Papers III and IV had longitudinal designs. Sensitivity to sound (hyperacusis) in Paper I was assessed using questionnaires and the clinical test uncomfortable loudness levels. Perceptions of the psychosocial work environment and leadership behavior in Paper II were assessed using questionnaires. In Paper III, adherence to the web-based occupational health and stress management intervention was assessed using the number of logins, time spent logged in, and utilization of self-help exercises. This information was collected through database logs. In Paper IV, repeated measures with questionnaires were utilized to assess health, well-being, stress and aspects of the psychosocial work environment over time.

**Main findings:** Health-relevant personality traits were associated with all the tested outcomes. In Paper I, those with higher levels of negative affectivity were more likely to suffer from hyperacusis. Higher levels of negative affectivity increased the odds (OR) of having hyperacusis on average 4.6 times for men and 2.4 times for women. Paper II found correlations between HP5i, perceived psychosocial work environment and leadership behaviors. More specifically, hedonic capacity correlated positively with perceptions of the psychosocial work environment and leadership behavior. Those with high levels of this trait had better perceptions compared to those with lower levels of hedonic capacity. Negative correlations were found for negative affectivity, antagonism, impulsivity and alexithymia. This implies that those with higher levels of negative affectivity, etc. had worse perceptions of the psychosocial work environment and leadership behavior compared to those with lower levels of that trait. In Paper III, higher levels of antagonism and impulsivity were associated with fewer logins to the intervention, whereas higher levels of negative affectivity were associated with higher utilization of self-help exercises. Alexithymia negatively predicted the use of self-help exercises, whereas antagonism was a positive predictor. Negative affectivity positively predicted time spent logged in. Paper IV found that health-relevant personality traits were associated with repeated measures of health, well-being, stress and indicators of the psychosocial work environment. Some of these changes over time were partly explained by higher levels of negative affectivity. Health-relevant personality traits also predicted individuals' typical ratings of these health and psychosocial work environment indicators. Moreover, the repeated measures displayed seasonal variations over time.

**Conclusions:** The results of Papers I – IV illustrate that health-relevant personality traits, to some extent, are associated with indicators of health and the psychosocial work environment. Although some of these associations have been previously studied, the present thesis clearly illustrates that the findings are systematic and consistent for different samples and using both cross-sectional and longitudinal designs. Hence, health-relevant personality traits should be considered in clinical practice, both when assessing and interpreting results from questionnaires and when optimizing the design and implementation procedures for occupational health interventions.



## LIST OF SCIENTIFIC PAPERS

- I. Villaume, K. & Hasson, D. (2017). **Health-relevant personality is associated with sensitivity to sound (hyperacusis)**. *Scandinavian Journal of Psychology*, 58, 158-169.
- II. Villaume, K. & Hasson, D. (2017). **Employee health-relevant personality traits are associated with the psychosocial work environment and leadership**. *International Journal of Occupational and Environmental Health*, p. 1-15.
- III. Villaume, K., Tafvelin, S., Hasson, D. **Health-relevant personality traits in relation to adherence to a web-based occupational health promotion and stress management intervention**. *Submitted manuscript, 2017*.
- IV. Villaume, K., Tafvelin, S., Hasson, D. **Health-relevant personality traits are associated with measures of health, well-being, stress and psychosocial work environment over time**. *Submitted manuscript, 2017*.

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## LIST OF ABBREVIATIONS

HP5i	Health-relevant Personality 5 inventory
FFM	Five Factor Model
WebbQPS	Web-based Questionnaire for Psychological and Social factors at work
ULL	Uncomfortable Loudness Level
HINT	Hearing-in-noise test
PTA	Pure tone audiometry
HR	Human resources
NB	Negative binomial (regressions)
HQ	Hyperacusis Questionnaire
SRH	Self-rated health

# 1 INTRODUCTION

The present thesis investigates health-relevant personality traits in relation to indicators of health, psychosocial work environment and adherence to a web-based occupational health promotion intervention. The overall aim is to contribute with knowledge about the possible role that health-relevant personality traits may have when it comes to health, ill-health and the psychosocial work environment. This information could be highly relevant in practical terms. For example, a better understanding of the characteristics of those who utilize a stress management intervention, could be valuable for those who design and implement such interventions. A person may have different needs and expectations that could be valuable to consider in order for interventions to yield adherence and optimal outcomes. Furthermore, a better understanding of the constituents of health and psychosocial work environment assessments, may facilitate the interpretation of them and guide subsequent actions or interventions.

For centuries, scientists and philosophers have been interested in understanding the foundations of our behaviors [1]. The Ancient Greeks and influential philosophers such as Hippocrates, Plato and Aristotle began to organize individuals based on certain attributes, such as for instance being hot or cold. Later on, Shakespeare and others were able to amuse the audience by describing typical and universal attributes of their characters. Thus, theater and acting came to play a part in the development of personality research. Since then, a number of influential psychologists such as Sigmund Freud, Carl Jung, Henry Murray, Gordon Allport and many others contributed to the development of what we today refer to as personality [1]. Contemporary personality theories date back to the 1930's, where the interactions of individual, environmental and contextual variables are highlighted.

About 35 years ago, studies examining relationships between personality, health, ill-health and disease flourished [1, 2]. Numerous scientific contributions have yielded a better understanding of the extent to which individual characteristics are associated with health and health behaviors [2, 3]. For example, individuals who tend to be emotionally balanced, and have social support tend to be less likely to develop ill-health or disease compared to individuals who tend to be hostile, tense or frustrated [2]. However, this is a very simplified statement, since it is well-established that there are no clear, linear associations, but complex interactions with situational, genetic and environmental circumstances.

The interest for personality research has also been extended to workplaces in order to better understand how individuals experience, behave and perform at work [4-10]. Work-related personality research includes personality testing for staff recruitment, job satisfaction, work performance, motivation and attitudes towards work for instance [4]. Other studies within this field investigate personality in relation to risks for work-related ill-health and disease [11-13]. There are, for example, associations between personality and perceived stress [14] and absenteeism [4]. Indeed, understanding the relationships between work-related variables and health or risk for ill-health are important. More than half of the global population can be seen

as belonging to the workforce, and the World Health Organization (WHO) has declared occupational health to be a prioritized issue [15]. At present, much is known about the associations between work-related factors and risks for employee ill-health. However, less is known about how to improve and sustain healthy work-environments for all [16]. Organizations may implement interventions to improve occupational health, but little is known about which interventions that work for whom or why [16]. Occupational health interventions are complicated to design and evaluate, since there are numerous aspects to consider and that can influence outcomes. One of these aspects might be individual differences, e.g., personality. Since personality has been associated with health and work-related aspects, it could also be of importance in relation to occupational health interventions. Therefore, the present thesis will investigate and describe this further.

## **2 AIM**

### **2.1 OVERALL AIM**

The overall aim of this thesis is to examine possible relationships between health-relevant personality traits, health, psychosocial work environment and occupational health intervention adherence.

### **2.2 SPECIFIC AIMS**

*Paper I* aimed to investigate health-relevant personality in relation to one aspect of health, or ill-health, namely sensitivity to sound (hyperacusis).

*Paper II* aimed to explore possible associations and differences in mean values between employee health-relevant personality traits and assessments of the psychosocial work environment and leadership behaviors.

*Paper III* aimed to investigate possible associations between health-relevant personality traits and adherence and if these traits predict adherence to a web-based occupational health intervention.

*Paper IV* aimed to investigate health-relevant personality traits in relation to health-related variables and indicators of the psychosocial work environment using repeated assessments over time. The paper also investigated if these personality traits could predict changes in perceptions of health and psychosocial work environment over time.





### **3 BACKGROUND**

The present thesis touches upon several broad research fields that are not always easily synthesized. This section aims to provide a brief overview of the research fields of personality, psychosocial work environment and occupational health interventions.

#### **3.1 DEFINING AND ORGANIZING PERSONALITY**

Personality has been an area of interest within several different research fields, although predominantly within psychology. There are hundreds and thousands of publications within the area, yet there is no universal definition of personality. However, personality can be defined as “a person’s cognitive, affective or behavioral tendencies that are fairly stable across time and situations” [17]. Roberts and Mroczek [18] clarify that personality traits refer to ‘the relatively enduring patterns of thoughts, feelings, and behaviors that distinguish individuals from each other’ (p. 31). Thus, personality is what makes us unique and, there seems to be some predictability and stability in how we tend to behave and feel.

Personality research has a long and lively history of debate regarding how to organize or categorize dimensions and aspects of our personalities, to incorporate the whole and complete spectrum in a meaningful way [19]. More specifically, the debate has concerned the number of dimensions, also referred to as factors that personality can be organized into. These factors have ranged between 3 and 16 [20-23]. The debate is still ongoing to some extent, although there is some consensus that personality can be organized into five broad factors with several lower-order traits or facets [24, 25]. This model, referred to as the Five Factor Model (FFM) or The Big Five (described below) is widely used in research, but has received some critique [19]. The main concerns have been about how this model was developed in the first place, i.e. by emanating from language rather than theory, and which statistical methods that were used.

The FFM emanates from adjectives that describe individual attributes in language [21-23, 26]. Thousands of adjectives were collected and analyzed with a statistical method called factor analysis, in a way to find underlying patterns or clusters within these adjectives [21]. Several independent research groups concluded that these adjectives, in for instance English, German and Chinese could be statistically organized into five broader categories with several sub-categories [22]. This approach was considered to support the notion that personality can be organized into five broad dimensions. Critics have raised concerns regarding how these factor analyses were performed, i.e., rotated, and the fact that the model emanates from data (adjectives), rather than theory [21, 22]. There have also been discussions regarding measurement invariance, i.e., if the FFM is a valid and applicable framework across cultures [27, 28]. Some studies suggest that there are cultural aspects in personality that the FFM does not account for [29, 30], and that there are cultural differences in response patterns that limit the validity of cross-cultural comparisons with the FFM. Although this debate is most likely far from over, the FFM is widely used as a general framework today [19].

### **3.1.1 The Five Factor Model**

The Five Factor Model (FFM) is organized into higher-order, or broader traits or lower-order, more specific traits or facets [26, 31]. Several scientists were involved in the development of what was later referred to as the FFM [23]. However, in 1961, Tupes and Christal were the first to develop and publish the FFM model, which was later revised by others.

The FFM is a broad model that is only briefly described here. Extraversion is a broad dimension with traits or facets such as positive emotions, enthusiasm, assertiveness, sociability, being energetic, active and seeking excitement in life [1, 32]. Neuroticism, sometimes referred to as Emotional instability, is the broader dimension that includes aspects such as anxiety, distress, worrying and tension. The Openness dimension includes traits such as being curious, imaginative, aesthetic, and original. Agreeableness includes aspects such as friendliness, cooperation, altruism and trust. Conscientiousness is a broad dimension including traits such as being dependable, competent, organized and responsible [33, 34].

## **3.2 MEASURING PERSONALITY**

There is no gold standard as to how to define nor assess personality. This makes it difficult to draw general conclusions about study outcomes, considering that different personality measures may not always be comparable. There are several approaches to assess personality, such as ratings by others, observations and questionnaires with self-ratings [1]. These approaches all have their strengths and weaknesses. For instance, ratings by others can be valid measures for measuring personality traits in children [35]. However, ratings by others may entail bias if the raters have limited knowledge about the individual being assessed or if there is some kind of dependency between them [36, 37]. Self-ratings of personality are widely used and reliable overall [36, 38]. Some have discussed biases such as faking or social desirability in self-ratings, particularly in personality measures in staff recruitment and in experimental studies [38, 39]. Although this debate is still ongoing, there is some support for the notion that the risk for these biases are quite low in practice [38].

If choosing to measure personality using questionnaires, it can be challenging to know which one to choose among the multitude of available inventories. A commonly used inventory, based on the FFM, is the NEO-PI-R [32] consisting of 240 items. One of the advantages with this inventory is that it is well-established, which makes comparisons between studies easier to make. However, some argue that measuring broad, higher order dimensions as the NEO-PI-R might not always be the best approach, at least when it comes to predictions [40-43]. It has been proposed that more narrow and specific measures may be more appropriate in certain circumstances, for instance to investigate associations between personality and aspects of health [41, 42]. Broad measures have been found to be useful when investigating broad health indices, whereas specific measures at the lower trait or facet level can be valuable when assessing more specific outcomes, such as health behavior [41, 42]. Furthermore, in large intervention studies or epidemiologic studies, broad-dimensional inventories may not be practical nor feasible due to participants' time constraints. The NEO-PI-I takes approximately

45 minutes for the respondents to complete [44], which might not be practical nor possible to include in for instance longitudinal studies with several other variables being assessed at the same time. More specific and shorter inventories may increase response rates and facilitate complete responses to the inventories. Furthermore, questionnaires with better precision can be more tailored to the research questions that can be quite specific. More precise assessment methods can make it easier to analyze, interpret and make sense of the results. In the present thesis, the specific and brief inventory (HP5i) was utilized. It will be described in more detail below.

### **3.2.1 Health-relevant personality**

The Health-relevant Personality 5 inventory (HP5i) was developed by Gustavsson et al. [45] to be used in research about personality and health. This includes, for instance, longitudinal cohort studies and intervention studies where there may be a need to assess more specific health-related aspects in relation to outcomes. The HP5i consists of the following constructs based on the FFM.

*Hedonic capacity* is a facet of the broader FFM dimension Extraversion. Individuals with higher levels of hedonic capacity tend to engage in goal-directed behavior, be positive and enjoy life [45, 46]. This relates to health in the sense that individuals who have higher levels of hedonic capacity tend to be engaged in more health promoting behaviors and be more goal-oriented when faced with adversities, such as ill-health or disease.

*Negative affectivity* is a facet of Neuroticism, and individuals with higher levels of negative affectivity tend to be nervous and tense. Negative affectivity is related to health in the sense that persons with higher levels of this trait tend to rate poorer health and report more disease symptoms.

*Antagonism* is a facet of Agreeableness and is inversely related to this dimension. Thus, an individual with higher levels of antagonism tends to be hostile, aggressive and cynical.

*Impulsivity* is an inversely-related facet of the FFM dimension Conscientiousness. Highly impulsive individuals tend to act on the spur of the moment without really thinking or planning ahead. Impulsivity has been positively related to risk-taking behavior, i.e., a tendency to engage in risky health behavior such as for instance excessive alcohol consumption and smoking.

*Alexithymia* is an inversely-related facet of Openness. Individuals with higher levels of alexithymia tend to have difficulties expressing and analyzing feelings and emotions. Alexithymia may be more easily understood in relation to Openness in the far end of the continuum. Openness represents creativity, being aesthetic and highly expressive when it comes to feelings and emotions. Alexithymia is on the opposite side of that continuum, and individuals who score high on this scale tend to avoid analyzing their own and others' emotions. Alexithymia has been positively related to engaging in unhealthy behaviors, increased symptom reporting and negatively related to adherence to treatment [45].

### **3.3 PERSONALITY IN RELATION TO HEALTH**

Personality has been comprehensively investigated in relation to health and disease [2]. The relationships have been found to be complex and multidimensional [2, 47]. Neuroticism and negative affectivity have been most consistently associated with reports of poorer health and more physical and mental symptoms compared to those with lower levels of those traits [2, 3, 42, 47-58]. Moreover, extraversion and conscientiousness have been associated with better health and well-being. Personality can cause, mediate and promote ill-health and illness directly or indirectly through related unhealthy behaviors, such as smoking, substance abuse, sleep loss, poor eating habits, etc. It has also been suggested that personality might influence responses to illness, behaviors and treatment through genetic predispositions, coping mechanisms, adherence to treatments and adaptation for instance [51, 59-61]. Similarly, diseases can cause changes in personality and behavior [61, 62].

#### **3.3.1 Sensitivity to sound (hyperacusis)**

One health aspect that will receive attention in this thesis is sensitivity to sound, clinically described as hyperacusis. Hyperacusis has previously been positively associated with stress, i.e., emotional exhaustion, [63] but the etiology is not fully understood. In some cases, hyperacusis may occur as a result of damage or disease in the middle ear [64] and hyperacusis is common among those suffering from tinnitus [65, 66]. The prevalence of hyperacusis is not clear, mainly since the measures and definitions of hyperacusis vary between studies. A Swedish study report that hyperacusis is prevalent in approximately 8 – 9 % of the general population [67]. However, this was assessed through self-ratings and the prevalence might be different when assessed clinically. The personality trait neuroticism has been associated with hyperacusis and noise sensitivity [68, 69]. There is however a void of scientific studies regarding possible associations between personality and hyperacusis.

### **3.4 SUGGESTED MECHANISMS AND ASSOCIATIONS BETWEEN PERSONALITY AND HEALTH**

For the last decades, researchers have investigated possible mechanisms that may explain the associations between personality and health, particularly for neuroticism and negative affectivity [2, 48, 55, 56]. Three main hypotheses have been proposed – the psychosomatic hypothesis, the disability hypothesis and the symptom perception hypothesis. The psychosomatic hypothesis suggests that higher negative affectivity or neuroticism causes poor health or health problems through a chain of mechanisms and behaviors [55, 56]. This view would suggest that highly neurotic individuals tend to find themselves in unhealthy environments where there is a higher likelihood of engaging in unhealthy behaviors such as for instance excessive alcohol consumption, substance abuse etc. This in turn would increase the likelihood of ill-health or disease. The disability hypothesis proposes the reversed causality, that poor health or health problems cause higher levels of negative affectivity or neuroticism [55, 56]. This view would suggest that the suffering that disease or ill-health entails make individuals display more neuroticism. The symptom perception hypothesis proposes that the key to understanding this relationship is the difference in how we perceive

and report bodily sensations. This hypothesis is supported by findings that individuals with higher levels of negative affectivity or neuroticism tend to perceive and pay attention to more or stronger sensations or bodily reactions. However, they may not necessarily be diagnosed with a disease [55]. These three hypotheses are all relevant and when combined, they might better explain the complex relationships between personality and health. Indeed, personality-related ill-health may be explained by unhealthy behaviors that cause disease or vice versa and combined with too much or too little attention to symptoms may bias reporting and outcomes.

In practice, it is challenging to generalize the outcomes from different studies about personality and health. This is due to the fact different studies utilize different ways of assessing health, ill-health and personality. Furthermore, the characteristics of the samples vary, e.g., ranging from large to small samples, healthy individuals, patients, elderly and young students. The combination of using different measures in different studies and the variety of samples, make comparisons between studies difficult. Therefore, it is currently not possible to draw general conclusions about causality when it comes to the associations between personality and health.

### **3.5 STABILITY OF PERSONALITY OVER TIME**

Historically, personality has been considered to be relatively stable over time, whereas more recent research suggests that personality is plastic, meaning that it is changeable [18, 35, 58, 70-72]. For instance, studies have found that neuroticism tends to decrease with age whereas extraversion seems to increase [18, 71, 73]. The mechanisms for this plasticity have not been established, but several possible explanations have been proposed. Changes in personality may be explained by environmental, contextual and social aspects [18, 71, 73]. This would mean that different situations and environments make us express different behaviors, i.e., different dimensions of our personality traits. This in turn, could either increase or decrease the likelihood of engaging in healthy behaviors. A certain environment or point in time may predispose someone to engage in unhealthy behaviors such as smoking, or excessive alcohol consumption, but not others. Thus, the interactions between the situation and personality are important to consider and understand in order to draw more accurate conclusions about mechanisms and the complexity regarding personality research.

### **3.6 DEFINING PSYCHOSOCIAL WORK ENVIRONMENT AND OCCUPATIONAL HEALTH**

According to the Encyclopedia of Behavioral Medicine [74], psychosocial work environment is defined as the “interpersonal and social interactions that influence behavior and development in the workplace” (p. 1587). Another definition, by Siegrist and Marmot [75], is that the psychosocial work environment encompasses the “range of sociostructural opportunities that is available to an individual person to meet his or her needs of well-being, productivity and positive self-experience” (p. 1465). Thus, the psychosocial work environment is a broad term, which is also reflected in the vast amount of research within this

field. It entails variables that are related to employee health, social interactions and productivity [76]. A large proportion of the research literature has focused on work-related stress and been influenced by models such as the Demand-Control Support model [77], the Effort-Reward Imbalance model [78] and the Job Demands-Resources model [79, 80]. These models aim to explain the associations between factors at work, such as demands, stressors the ability to recover.

The Demand-Control Support model suggests that certain combinations of demands, control (decision latitude) and support may be risk factors for ill-health. Individuals who are subjected to high demands with insufficient control and support are at risk for stress-related problems and ill-health [81]. High demands combined with sufficient control and support on the other hand, characterizes an active and healthy work situation. The Effort-Reward Imbalance model suggests that optimally, there is a balance or reciprocity between the efforts an individual invests in and the rewards that they receive for these efforts [78]. The combination of high efforts and low rewards have been found to predict for instance poorer self-rated health [82] increased risk for cardiovascular disease [78] and has been associated with lower immune system functioning [83]. The Job Demands-Resources model is similar to the above-mentioned models as it also suggests a balance between the demands at work and the resources available. This model suggests that high job demands in combination with low resources has a negative impact on the individual and can lead to stress-related problems such as for example burnout [79, 80, 84, 85].

Occupational health is an even broader term that includes dimensions of the psychosocial work environment as well as physical aspects. According to the World Health Organization (WHO) occupational health involves safety as well as psychosocial and physical health at the workplace [15]. Traditionally, occupational health primarily concerned the physical work environment and hazards at work, such as accidents and injuries [86]. However, the term encompasses psychosocial, organizational and contextual variables as well [15].

### **3.7 PERSONALITY AND ASPECTS OF THE PSYCHOSOCIAL WORK ENVIRONMENT**

The association between personality and work-related factors and behaviors has been extensively studied for the last decades [87] and there are numerous publications within this field [10]. Overall, these studies report that personality traits are associated with job performance and work-related behaviors. There is increasing evidence that personality traits play a role in work-related behaviors such as sickness absenteeism and work success [4]. For instance, higher levels of neuroticism are associated with increased sick-leave rates and negatively predict work success.

Personality has also been widely investigated in the job stress area and associations have been found between personality and perceptions of stress as well as related behaviors [11-14, 88]. Some personality traits are related to the number of stressful encounters individuals experience, how they perceive these encounters as well as how they react to them. For

instance, those with higher neuroticism scores tend to experience more stressful situations, daily hassles and low decision latitude in combination with high demands. Those with higher levels of extraversion and conscientiousness tend to experience less stress [13, 14]. Hence, there are well-established associations between personality, stress perceptions and thereto related behaviors.

Personality is frequently mentioned in the job satisfaction literature. As an example, it has been found that higher levels of neuroticism predicts lower job satisfaction [89]. A similar study found that the personality traits extraversion (positivity), neuroticism and conscientiousness (e.g., dutiful) all predicted job satisfaction. More specifically, individuals scoring higher on positive emotion (positivity) experienced more job satisfaction whereas those scoring higher on negative affectivity experienced less job satisfaction [90]. Several examples in the literature report similar results; namely that personality traits are moderately correlated with job satisfaction. In most studies, the strongest associations have been found between higher levels of neuroticism or negative affectivity and lower levels of job satisfaction [6, 9, 88, 90-93]. Personality also correlates with perceived leadership. More specifically, those who score high on extraversion, conscientiousness, openness to experience and agreeableness and low on neuroticism perceive their leaders to exhibit more transformational leadership styles, i.e., leader characteristics such as being inspirational, encouraging, supporting etc. [94-96]. In sum, there seem to be consistent and systematic findings suggesting that personality is, to some extent, related to work-related behaviors and aspects in the psychosocial work environment.

### **3.7.1 Measuring and evaluating aspects of the psychosocial work environment**

Organizations commonly engage in efforts to measure employee perceptions of health, the psychosocial work environment and safety at work. The type of workplace will determine which aspects that are assessed [97]. Traditional risk assessments aim to ensure that employees stay away from harm and illness [98]. However, there is no consensus as to which aspects that should be measured or how this data should be collected. Data can be collected in several ways, for instance through observations, interviews, analyses of sick-leave data and through questionnaires. The present thesis collected data primarily through web-based questionnaires, which will be described below.

#### *3.7.1.1 WebbQPS*

An example of a questionnaire to assess employee health and aspects of the psychosocial work environment is the WebbQPS [99]. The survey is partly based on the Questionnaire of Psychological and Social Factors at Work, QPS<sub>Nordic</sub>. It was developed by the Nordic Council of Ministers to assess health, lifestyle and aspects of the psychosocial work environment [100]. WebbQPS was developed as a short form of QPS<sub>Nordic</sub> that could be easily administered by organizations to assess the most common public health problems and central indicators of the psychosocial work environment [99]. The most common public health

disorders include, for instance, symptoms of long-term stress, prevalence of musculoskeletal pain and the risk of developing type 2 diabetes. The aspects of the psychosocial work environment include, for instance, demands, control, support, control, clarity, positive challenges at work, leadership, work ability and work-life balance.

The idea behind WebbQPS was that it was supposed to be module-based and adapted to the different needs of different organizations [99]. Most aspects of the psychosocial work environment are assessed two-dimensionally in WebbQPS. This means that employees are asked to respond to a frequency dimension as well as a satisfaction dimension. In practice, this means that an employee for example is asked: “Does your immediate superior help and support you with your work?” Response alternatives are: “Very seldom/never”, “Quite rarely”, “Neither rarely nor often”, “Quite often”, “Very often/always”. Then, on the same row, the employee is asked: How satisfied or dissatisfied are you with that? Responses are then: “Very dissatisfied”, “Quite dissatisfied”, “Neither satisfied nor dissatisfied”, “Quite satisfied” and “Very satisfied”. The combination of these responses is then depicted in a matrix to display the different combinations of the frequency and satisfaction dimension (see Figure 1).

		How satisfied or dissatisfied are you with it?		
		Satisfied	Neither	Dissatisfied
Does your immediate superior help and support you with your work?	Often	42%	2%	0%
	Neither	8%	15%	5%
	Rarely	5%	9%	14%

Figure 1. An example of a two-dimensional matrix displaying the combination of the frequency dimension (rarely, neither or often) and the satisfaction dimension (satisfied, neither or dissatisfied) in the WebbQPS.

The satisfaction dimension has been found to add information that is not captured by the frequency dimension [101]. This makes sense, since individuals may differ in the need for support for instance. Some employees might be satisfied when they often receive support, while others prefer to rarely receive support from their immediate superior. This means that the employees themselves will value if they feel that the outcome is satisfactory for them or not. This is to counteract erroneous preconceptions and to ensure that the leader has a fact-based foundation for dialogue with the employees. Thus, these two dimensions are essential for managers in order to have an appropriate understanding of the responses, instead of assuming that the outcomes are good or bad. After conducting a dialogue with the employees to better understand the meaning of the outcome, they can design action plans or interventions for improvement together with the employees. If leaders emanate from employees’ own perceptions of whether low support or high demands for example is a



problem or not, it could help them direct action plans and interventions primarily to those who are in need of them. This may be more efficient instead of erroneously assuming that low support or high demands is a problem for all, and acting upon this information. Individuals who experience a problem are probably also more motivated to intervene compared to those who do not feel that they have a problem.

### **3.8 OCCUPATIONAL HEALTH INTERVENTIONS**

Organizations may engage in a multitude of different occupational health interventions with various designs and pedagogics. One way of describing the strategies for interventions is conceptually taken from public health and transferred to occupational health. In this way, interventions are organized by what they aim to achieve, and can thus be broadly organized into primary, secondary and tertiary [102]. Primary interventions are proactive, meaning that they aim to promote health, prevent exposures to stressors and limit the occurrence of illness among healthy individuals or employees. These interventions aim to address the sources of stress in the workplace or stressors through changes in the physical or psychosocial work environments or through organizational changes. Secondary interventions are preventive actions that aim to improve or deal with existing problems at an early stage. For instance, stress management interventions may be implemented to help employees modify or control their perceptions of stressful situations. Tertiary interventions are reactive and are implemented to deal with existing problems. These interventions aim to minimize the effects of for instance stress-related problems, once they have occurred. This could be done by for instance treating symptoms or stress-related disorders. Organizations may focus on primary, secondary and tertiary interventions at the same time, but most commonly, the focus is on secondary and tertiary [102].

#### **3.8.1 Evaluating occupational health interventions**

Since it is common for organizations to engage in health promotion activities or interventions, research has been conducted to better understand why some interventions work while others fail [103]. More specifically, numerous studies have been conducted to better understand which factors and circumstances that are needed for occupational health interventions to be successful. However, organizations are complex and evolving, which makes it complicated to evaluate occupational health interventions [104]. Using traditional research approaches such as randomized, controlled trials may be challenging in organizational settings because it is impossible to control all variables that may confound the results. Indeed, this is also true for other research approaches. Therefore, it can be wise to combine different approaches, such as both questionnaires, clinical tests and interviews. In this way, both qualitative and quantitative ways of analyzing data can be utilized. Irrespectively, there are several approaches to evaluate occupational health interventions, but there is no consensus as to how interventions should optimally be evaluated. There are advantages and disadvantages with every method and design. A combination of designs may therefore mitigate and counteract some of the weaknesses in each approach.

Some studies focus on investigating specific outcomes before and after the intervention to draw conclusions about the effectiveness of an intervention. However, this approach may leave several questions unanswered regarding what really happened during the time of the intervention. This means that analyses of effectiveness should optimally be completed with process evaluations that can describe facilitating, hindering, moderating and mediating factors [105]. Another aspect that complicates the evaluation of occupational health interventions regards the outcomes measures. There is a multitude of outcome variables that can be used, even when assessing the same phenomenon. A meta-analysis by Richardson & Rothstein [106] investigated 36 experimental occupational stress management studies. They found that 60 different outcome measures were used to evaluate whether the interventions yielded beneficial effects. Furthermore, stress (which was the primary outcome) was measured with 11 different scales.

### *3.8.1.1 Aspects to consider when evaluating occupational health interventions*

The literature reports on numerous variables and aspect that may influence the outcomes of occupational health interventions. These range from organizational prerequisites, to individual variables as well as intervention specific aspects. Organizational variables such as budget cuts/downsizing, company and/or group mergers, management and organization strategies and job types are a few examples of variables associated with intervention outcomes [107, 108]. Hence, these variables should be taken into consideration when evaluating occupational health interventions since they can impact the outcomes. The importance of a supportive top management and active line managers has also been highlighted. Traditionally, leaders have been pointed out as important drivers of work environment initiatives and occupational health interventions [109, 110]. Senior management can influence the intervention by communicating support and by allocating resources [107]. Line managers, i.e., managers hierarchically right above the non-managerial workers, are typically appointed to be responsible for occupational health interventions [111]. They are usually the ones transferring organizational policies, plans, actions or interventions to practical use for the employees [112]. Thus, management and leadership aspects can partly explain why certain interventions yield beneficial outcomes or not.

The components or content of the intervention as well as the implementation of it have also been identified as important variables associated with success or failure of occupational health interventions [113, 114]. The intervention itself and its components can be more or less relevant or applicable for a given organization, group, individual or context. Likewise, the importance of *how* an intervention is implemented has been highlighted [115-117]. Interventions that are firmly established in the whole organization before roll out, have a better chance of achieving the desired outcomes [118]. A systematic review that evaluated occupational health interventions, in this case stress management programs, concluded that there are difficulties in determining whether the implementation or the actual intervention is successful or not [105]. One explanation for this is that most intervention studies do not conduct process evaluations to investigate the possible role of the implementation procedure.

Therefore, it is impossible to know to what extent an intervention succeeded or failed due to the intervention itself or due to the good or poor implementation of it [105].

Employees' perceptions and appraisal of occupational health interventions have also been highlighted and need to be considered in evaluating interventions [118]. This area is in line with research on personality – i.e., there are individual differences in aspects related to the organizational setting. Individuals' motivational strategies seem to matter and this is something that needs to be taken into consideration when designing and implementing interventions, as well as when evaluating them. Some studies explicitly investigate how we appraise an intervention [119, 120]. Appraisal seems to mediate participation (adherence) and intervention outcomes. If individuals perceive that the intervention is relevant, of high quality and actually leads to change they are more likely to engage in it. Furthermore, the same intervention can be perceived differently depending on the individual, the work group and the organizational setting [119]. However, there is little knowledge about personality and occupational health interventions. This knowledge could yield a better understanding of the characteristics of individuals that engage in the intervention. It could help explain which specific components highly engaged individuals utilize and the characteristics of individuals who refrain from engaging in these kinds of interventions. In extension, this may provide valuable information about how organizations can tailor their interventions to target the whole organization and optimize adherence. In sum, evaluating occupational health interventions is complex since there are several variables to consider, and they can be assessed in different ways.

### **3.8.2 Utilization of an intervention – adherence**

Another way of evaluating occupational health interventions is by assessing the extent to which the intervention is actually used. Different research traditions use different terminology to evaluate utilization of an intervention. Within process evaluations, the terms reach or dose-received are used to assess the extent to which the target group was reached by the intervention and utilized it as intended [105, 121]. Another term to assess the same phenomenon is participation, which may be used for occupational interventions. For example, some studies evaluate interventions by assessing participation rates as well as the characteristics of those who participate [122, 123]. Web-based interventions, e.g., stress management, seem to use the term adherence when evaluating utilization [124-126]. This term is also used in healthcare settings to evaluate the extent to which patients follow the recommendations given by the healthcare provider [127]. In web-based interventions, adherence can be assessed in different ways, but most frequently by logging behavior such as the number of times individuals log in to the web-page and the number of components they use [124, 128]. Several studies have investigated predictors of adherence to web-based disease treatment interventions, like depression or anxiety [124, 129]. However, little is known about adherence to web-based health promotion interventions, particularly within occupational settings. Furthermore, fewer studies have investigated personality in relation to adherence. The few studies that have, can primarily be found with healthcare settings [130-

134]. These studies provide no clear associations but, for instance, neuroticism has been found to negatively predict adherence [131, 134].

## 4 METHODS

The four papers in this thesis utilize data from three separate studies. These will be briefly described in the following section.

*Paper I* utilizes data from the experimental **Stress and Hearing study** conducted in 2009. The overall aim with this study was to investigate possible associations between stress and hearing problems. The study included an experimental component. A 5-minute stress task was conducted at a clinic in Stockholm and consisted of a cold pressor test (individuals had their hand on ice cold water), an emotional Stroop test as well as social stress exposure, i.e., close-up filming of facial expressions during the stress task. Audiological measures and biomarkers were collected before and after the stress task, and a web-based questionnaire was completed approximately three days before the clinical assessments at the clinic. In Paper I, data prior to the acute stress task is utilized.

*Paper II* is based on data from the longitudinal **Work with Flow intervention study** conducted in 2011 – 2013. This study utilized a web-based intervention for stress management and occupational health promotion (described below). The overall aim was to optimize work ability and job satisfaction as well as to reduce sick-leave, presenteeism and ill-health.

*Papers III and IV* are based on data from the longitudinal, randomized, controlled **PAUS intervention study** conducted in 2014 – 2015. The overall aim of this study was to compare a web-based intervention for stress management and health promotion utilized at the individual level, versus a version that was completed with additional components at the group and organizational level. The organizations were randomized to receive the individual level intervention (control group) or the individual, group and organizational intervention (treatment group). However, the treatment group did not utilize the organizational intervention as intended. This means that no differentiation is made in the analyses between the treatment group and the control group, as they all received the intervention at the individual level. A sub-study was performed during the intervention. A randomized, placebo-controlled, double-blind study was performed to investigate possible effects of the dietary supplement magnesium compared to placebo. Evaluations of possible effects regarding recovery, sleep, infections, hearing problems, pain, etc., were made using web-based questionnaires and audiological measures before and after three months of magnesium/placebo intake. The sub-study will not be addressed in this thesis.

### 4.1 DESIGNS

Paper I had an experimental cross-sectional design. Paper II had a cross-sectional design, and Papers III and IV had longitudinal designs. In Paper III, data were collected through database logs throughout the intervention. In Paper IV, questionnaire data were collected regularly (weekly or more often) during 20 consecutive months, i.e., throughout the intervention.

## **4.2 PARTICIPANTS**

### **Paper I**

Participants were recruited through the longitudinal Swedish Longitudinal Occupational Survey of Health (SLOSH) from 2008. [135]. A total of 348 out of 671 eligible individuals enrolled and the demographic characteristics are presented in Table 1 in Paper I.

### **Paper II**

Participants were recruited through a Swedish insurance company. 19 white-collar organizations were invited to participate, out of which ten agreed to participate with all employees or selected teams or departments. The organizations represented both private and public sectors within industries such as media, telecom, pharmaceuticals, medical and IT research, financial auditing and government agencies. During the course of the intervention, 2,519 individuals were invited to participate. Of these, 754 individuals were included in the analyses for Paper II. A detailed description of the flow of the participants can be found in Figure 1, Paper II.

### **Papers III and IV**

The study participants were employed at 21 primary schools in Stockholm, Sweden. The intervention targeted 2,090 individuals, of which 1,001 (48 %) enrolled in the main intervention. Of these, 563 individuals were included in Paper III and 517 individuals were included in Paper IV. All employees at the 21 primary schools were invited to participate, meaning teachers, administrators, librarians, janitors, student health practitioners, cafeteria personnel etc.

## **4.3 INTERVENTIONS**

In Papers II, III and IV, the same web-based health promotion and stress management intervention was utilized, i.e., the tools and services provided by HealthWatch.se. The intervention is further described below.

### **4.3.1 Web-based health promotion and stress management**

Papers II, III and IV utilized the same web-based intervention tool at the individual level. A brief description of the intervention is presented below, and more detailed descriptions can be found in Papers II, III and IV and elsewhere, e.g. [136, 137].

The web-based intervention tool, HealthWatch.se, consisted of four main parts: a) screening, b) feedback and monitoring, c) actions, and d) health and stress information. The screening was made through a brief, 15-second questionnaire with 11 items (see Figure 2). The screening questions assessed self-rated health, sleep quality, concentration ability, stress, energy, control, social support, work efficiency, job satisfaction, workload and work

atmosphere. The participants received immediate feedback on their responses and were able to monitor their ratings over time. Each individual could choose how often she/he wanted to respond to the 15-second questionnaire and could set their own reminders through the web-based system. Moreover, the tool included self-help exercises for stress management and health promotion, as well as a diary for expressive writing. There was also information within areas such as health, stress, diet, exercise etc.

Apart from the individual level intervention, there were additional features to promote systematic improvements of the psychosocial work environment through feedback and trends displayed at the group and organizational levels. The individual responses from the 11-item brief questionnaire (Figure 2) were aggregated to group-level results. In Paper II, the leaders were able to display these group results regularly (given at least 10 responses and at least 50 % response rate) and conduct a dialogue about them together with the workgroup. The aim with these dialogues were to jointly come up with potential interventions or actions in order to sustain or improve the psychosocial work environment. This additional function was not used in Papers III and IV (see Methods sections in Papers III and IV).

#### **4.3.2 Implementation**

The web-based intervention was introduced in the same structured way in Studies II, III and IV. In Study II, the management teams, including HR at the organizations were informed about the intervention tool, the scientific background and how they could use it. This information was provided through a one-hour oral presentation held by the research team. Secondly, the managers were gathered for a one-hour presentation of the same information as the management had received. Thirdly, the employees were invited to a one-hour inspirational presentation where the same information was provided by the research team. At the end of the presentation, personal links were sent out by email to sign up to the web-based tool and to respond to an extended baseline questionnaire (WebbQPS).

In Studies III and IV, the management and union representatives were informed about the intervention, and thereafter, the managers were briefly informed. This was done orally for some, and others received written information (see Methods section in Paper III for a full description). The employees were invited to a one-hour inspirational presentation, and thereafter they received personal links to sign up on the web-based tool and respond to the baseline extended questionnaire (WebbQPS). For a detailed description of the implementation model, please see for instance Hasson & Villaume [136].

#### **4.4 EVALUATION**

All studies were evaluated using questionnaires. Study I also utilized audiological measures (described in more detail below) and Study III utilized data from database logs together with the questionnaire data (see below).

#### **4.4.1 Questionnaires**

All questionnaires utilized in Papers I – IV emanated from WebbQPS. In all three data collections, participants responded to approximately 150 – 300 questions covering areas such as health, disease symptoms, hearing (hyperacusis, tinnitus, hearing loss) as well as lifestyle, personality, coping and aspects of the psychosocial work environment. The specific questionnaire items utilized in each paper are described below.

Health-relevant personality (HP5i) was utilized in all papers. It consists of 20 items assessing five health-relevant personality traits: hedonic capacity, negative affectivity, antagonism, impulsivity and negative affectivity. An example of an item assessing hedonic capacity is: “I’m always keen to try out new things”. One of the items assessing negative affectivity is: “I often feel uneasy and uncomfortable for no apparent reason”. An item from the subscale assessing antagonism is: “If someone criticizes me, I’m not afraid of giving sharp and sarcastic answers”. An example of an item aiming to capture impulsivity is: I have a tendency to act on the spur of the moment without really thinking ahead”. Lastly, an example item from the alexithymia subscale is: “I think people often tend to exaggerate the importance of their emotions” [45]. Responses were given on a 4-point Likert scale with the response alternatives: “Applies completely”, “Applies pretty much”, “Does not apply very well” and “Does not apply at all”.

##### **Paper I**

The Hyperacusis Questionnaire (HQ) was utilized to assess hyperacusis [138]. It consists of 14 items divided into three sub-scales, attention, social and emotional dimensions of hyperacusis. The attention dimension aims to capture attentional problems regarding sound exposure. An example item from the attention dimension is: “Do you have trouble concentrating in noisy surroundings?” The social dimension aims to assess social behaviors in relation to sound, such as the item: “Do you find the noise unpleasant in certain social situations (e.g., night clubs, pubs or bars)?” The emotional dimension aims to assess emotional reactions in relation to sound. An example of an item is: Does noise and certain sound cause you stress and irritation?” [138]. The responses were given on a 4-point Likert scale with the response alternatives: “No”, “Yes, a little”, “Yes, a lot” and “Yes, all the time”.

##### **Paper II**

Five dimensions from a modified version of QPS<sub>Nordic</sub> were utilized to assess the psychosocial work environment. These were: managerial support, positive challenges at work, work demands, control and job clarity. Managerial support included items such as “Does your immediate superior help and support you with your work?” Positive challenges at work contained items such as “Do you feel that your work is meaningful?” Work demands included items such as “Do you have too much to do?” Control had items such as for instance “Can you influence decisions that are important to your work?” Lastly, job clarity comprised items such as “Do you know exactly what is required of you at work?” [99, 100].



Two sets of responses were given for each item; frequency and satisfaction. The frequency dimension was a 5-point Likert scale with the response alternatives: “Very often/always”, “Quite often”, “Neither rarely nor often”, “Quite rarely” and “Very seldom/never”. The satisfaction dimension was a 5-point Likert scale with the response alternatives: “Very satisfied”, “Quite satisfied”, “Neither satisfied nor dissatisfied”, “Quite dissatisfied” and “Very dissatisfied”. Since each item had two sets of response alternatives, they were treated as 38 separate items.

Leadership behaviors were also assessed with six items derived from the Developmental Leadership Questionnaire (DLQ). An example of an item is: “Does your immediate superior take responsibility for the organization – even in adversity?” [139]. Responses were given on a verbal rating scale (VRS) with the response alternatives “Always”, “Quite often”, “Sometimes”, “Rarely” and “Never”.

## Paper IV

Paper IV utilized repeated measures of the HW-11 questionnaire, depicted in Figure 2. These items assessed for instance self-rated health, stress, concentration ability, job satisfaction and workload. All items were phrased in a way to capture the current state, for instance “How do you feel right now?” Responses were given on verbal rating scales (VRS) with five descriptors on nine of the items. For two items (stress and work efficiency) responses were given on visual analogue scales (VAS) with two anchors.

Click the line below each question.

<p>1 How do you feel right now?</p> <p>Very unwell   A little unwell   Neither good nor unwell   Quite good   Very good</p>	<p>7 How satisfied are you with your social life right now?</p> <p>Very dissatisfied   Quite dissatisfied   Neither satisfied nor dissatisfied   Quite satisfied   Very satisfied</p>
<p>2 How did you sleep last night?</p> <p>Very badly   Quite badly   Neither well nor bad   Quite well   Very well</p>	<p>8 How efficient are you at work right now?</p> <p>Not at all   Very satisfied</p>
<p>3 How is your ability to concentrate right now?</p> <p>Very bad   Quite bad   Neither good or bad   Quite good   Very good</p>	<p>9 How is your job satisfaction right now?</p> <p>Very dissatisfied   Quite dissatisfied   Neither dissatisfied or satisfied   Quite satisfied   Very satisfied</p>
<p>4 How stressed do you feel right now?</p> <p>Not at all   Very</p>	<p>10 How high is your work load right now?</p> <p>Very low   Quite low   Neither high or low   Quite high   Very high</p>
<p>5 What is your energy level right now?</p> <p>Empty of energy   Quite low   Neither high or low   Quite high   Full of energy</p>	<p>11 How is the job atmosphere right now?</p> <p>Very bad   Quite bad   Neither good or bad   Quite good   Very good</p>
<p>6 Do you have control over your life right now?</p> <p>None at all   Quite little   Neither much nor little   Quite a lot   Full control</p>	

Figure 2. The brief questionnaire for repeated measures. Image used with permission from HealthWatch.se.

#### **4.4.2 Audiological measures**

In paper I, direct, audiological measures were performed in a sound isolated booth in a hearing clinic in Stockholm, Sweden. Hearing status was assessed with pure tone audiometry (PTA) and hearing-in-noise test (HINT). Uncomfortable Loudness Levels (ULL) were performed in order to assess possible signs of hyperacusis. Briefly described, the ULL tests were performed on each ear to establish the sound level at which the participant experienced it to be uncomfortably loud. The tester sent a pure tone signal, starting at the sound level of 70 decibel (dB) to the participant. Thereafter, the sound level increased in 5 dB steps until the participant indicated through a microphone that the sound was uncomfortably loud. This procedure was repeated for the frequencies 500 Hz, 1 kHz, 2 kHz and 4kHz at each ear.

#### **4.4.3 Database logs**

Paper III utilized data logs to assess adherence. Three measures were logged in the database; the number of logins, the time spent logged in (in minutes) and the number of times an individual clicked on a self-help exercise. A participant was considered to be logged in when they accessed their personal account. This was where each participant had access to all the content in the web-based tool apart from the health and stress information, which was accessible even without logging on.

### **4.5 STATISTICAL ANALYSES**

Frequency distributions and Kolmogorov Smirnov tests were performed to assess normal distribution. For paper I, health-relevant personality was trichotomized based on tertiles or near tertiles, and based on quartiles or near quartiles in papers II and IV. In paper III, health-relevant personality was used as a continuous scale. Associations between health-relevant personality and the outcome variables were assessed using Pearson correlation coefficients and Spearman's rho. In Papers I and II, one-way analysis of variance (ANOVA) with Bonferroni post hoc tests were performed to investigate possible differences in mean values between levels of a personality trait (low, medium and high). In Paper I, multiple logistic regressions were performed to assess if health-relevant personality traits could predict hyperacusis. In Paper III, negative binomial (NB) regressions and zero-inflated negative binomial (ZINB) regressions with clustering correction (TYPE = COMPLEX) were performed to investigate if health-relevant personality predicted adherence. In Paper IV, multilevel growth curves were performed in order to investigate if there were changes over time in perceived health, well-being, stress and aspects of the psychosocial work environment. Furthermore, these analyses investigated cross-level interactions, e.g., if the growth parameters could be explained by health-relevant personality traits. As part of the predictions, individuals' typical ratings of the outcome variables were assessed, and health-relevant personality traits were added as predictors.

## **4.6 ETHICAL APPROVAL**

The Stress and Hearing study, presented in Paper I, was approved by the local ethical committee in Stockholm (protocol number 2009/493-31/3). The Work with Flow intervention study, presented in Paper II, was approved by the local ethical committee in Stockholm (protocol number 2010/1961-31/5). The PAUS intervention study, presented in Papers III and IV, was approved by the local ethical committee in Stockholm (protocol number 2014/274-31/5).

## 5 RESULTS

### 5.1 PAPER I

There were significant associations between health-relevant personality traits and hyperacusis measures. Moderate positive correlations were found between negative affectivity and the Hyperacusis Questionnaire (HQ), implying that higher levels of negative affectivity were associated with higher levels of hyperacusis symptoms. The associations were found for the total HQ score as well as all the dimensions (emotional dimension, attention dimension and social dimension). Moreover, negative affectivity was negatively associated with ULL on all the tested frequencies. This implies that higher levels of negative affectivity were associated with lower tolerance to sound. Impulsivity was positively associated with all dimensions of the HQ and ULL at some frequencies, indicating that higher levels of impulsivity were associated with higher levels of hyperacusis, at least measured with the HQ. Antagonism was positively associated with the emotional dimension of the HQ and negative associations were found for hedonic capacity and all dimensions of the HQ. Neither antagonism nor hedonic capacity were associated with ULL. There were some differences between women and men regarding the correlations. The one-way ANOVA revealed that there were significant differences in mean values between levels of personality traits and hyperacusis measures. For instance, those with high levels of negative affectivity were more sensitive to sound compared to low and medium levels of that trait, and those with high levels of hedonic capacity displayed lower signs of hyperacusis compared to those with low levels of that trait. The multiple logistic regression revealed that higher levels of negative affectivity increased the odds of displaying signs of hyperacusis by, on average, 4.6 times for men and 2.4 times for women.

### 5.2 PAPER II

Health-relevant personality traits were associated with perceptions of the psychosocial work environment and leadership behavior. Hedonic capacity was positively associated with all tested dimensions of the psychosocial work environment and leadership behavior. This means that higher levels of hedonic capacity were associated with better perceptions of managerial support, positive challenges at work, work demands, control, job clarity as well as leadership behavior. Moreover, higher levels of hedonic capacity were associated with both frequency and satisfaction dimensions. This means that those with higher levels of hedonic capacity perceived that they often experienced for example positive challenges at work, and more satisfaction with it. Negative affectivity, antagonism, impulsivity and alexithymia were negatively associated with leadership behavior and indicators of the psychosocial work environment. Thus, higher levels of these traits were associated with worse perceptions of the psychosocial work environment and leadership behaviors. The ANOVA demonstrated significant differences in mean values between low, medium and high levels of a personality trait and perceptions. More specifically, those with high levels of hedonic capacity perceived the psychosocial work environment and their leader's behavior to be better compared to those

with medium or low levels of that trait. For negative affectivity, antagonism, impulsivity and alexithymia, the results revealed that those with high levels of these traits in general had worse ratings compared to medium or low levels of these traits. The sex-separated analyses displayed some differences between women and men, but overall similar patterns in responses. One difference was that the correlations between hedonic capacity and perceptions of the psychosocial work environment and leadership behavior were somewhat stronger for men than for women.

### **5.3 PAPER III**

There were significant correlations between three health-relevant personality traits and measures of adherence. Higher levels of antagonism and impulsivity, for men, but not women, were associated with fewer logins to the web-based intervention. Furthermore, for men, higher levels of impulsivity were also associated with less time logged on to the intervention. The crude analyses revealed that higher levels of impulsivity were associated with the utilization of self-help exercises, implying that those with higher levels of impulsivity utilized the self-help components to a higher degree compared to those with lower levels of that trait. Negative affectivity was also positively associated with the utilization of self-help exercises, indicating that those with higher levels of negative affectivity utilized more exercises. In addition to associations between health-relevant personality traits and measures of adherence, it was found that personality predicted adherence. Negative affectivity positively predicted time spent logged in to the web-based intervention. Antagonism positively predicted the utilization of self-help exercises, whereas alexithymia negatively predicted the same adherence measure. There were some differences between women and men regarding these predictors. For example, for men, alexithymia positively predicted the number of logins, but not for women, whereas for women, negative affectivity positively predicted the utilization of self-help exercises.

### **5.4 PAPER IV**

There were weak to moderate correlations between most health-relevant personality traits and the indicators of health, well-being and psychosocial work environment. The visualization of the repeated measures of health, well-being, stress and aspects of the psychosocial work environment revealed clear seasonal variations in responses (see Figures 2 – 6 in Paper IV). There also appeared to be differences in absolute rating levels between high, medium and low levels of personality traits. These differences were particularly visible for hedonic capacity and negative affectivity. Those with high levels of hedonic capacity continuously seemed to rate better health and well-being as well as higher job satisfaction, work efficiency, workload and work atmosphere compared to those with medium or low levels of that trait. Those with high levels of negative affectivity appeared to continuously rate worse health, lower well-being and more stress compared to those with medium or low levels of negative affectivity. Furthermore, those with high levels of negative affectivity seemed to continuously rate lower job satisfaction, work efficiency and perceived the work atmosphere as worse compared to those with medium or low levels.

Multilevel growth curves revealed that seven out of 11 outcome variables significantly improved or increased over time, and for the remaining four outcomes, there was significant slope variance, meaning that individuals developed differently over time. The outcome variables concentration ability, energy and sense of control, perceived sleep quality and work efficiency significantly improved over time. Furthermore, perceived workload and stress increased. For the outcome variables self-rated health, job satisfaction, work atmosphere and social support, there was significant slope variance over time, implying that individuals' perceptions developed differently over time. The development, i.e., increase over time, in concentration ability, energy and sense of control was partly explained by negative affectivity. This implies that those with lower levels of negative affectivity measured at baseline, improved more over time. The development over time, i.e. change in job satisfaction was partly explained by negative affectivity and alexithymia, whereas the development in work atmosphere and social support was partly explained by negative affectivity. The development over time in self-rated health, sleep quality, work efficiency, workload and stress was explained by something other than health-relevant personality traits.

When investigating individuals' typical ratings of health, well-being, stress and psychosocial work environment aspects, health-relevant personality traits were found to predict these ratings. More specifically, those with higher levels of hedonic capacity typically rated better health, sleep, concentration ability, higher energy, more sense of control, more social support and job satisfaction. They also typically rated higher work efficiency, better work atmosphere and higher workload compared to those with lower levels of this trait. In sum, all variables except stress were predicted by hedonic capacity. Those with higher levels of negative affectivity typically rated worse health, well-being, more stress, lower work efficiency and worse work atmosphere compared to those with lower levels of that trait. Individuals with higher levels of antagonism typically rated lower energy, lower sense of control and lower job satisfaction compared to those with lower levels of that trait. Those with higher levels of impulsivity typically rated poorer sleep quality and worse concentration ability compared to those with lower levels of that trait.

## 6 GENERAL DISCUSSION

The aim of this thesis was to examine possible relationships between health-relevant personality traits and indicators of health, psychosocial work environment and occupational health intervention adherence. The results of Papers I – IV illustrate that health-relevant personality traits, to some extent, are associated with indicators of health and the psychosocial work environment. Although some of these associations have been previously studied, the present thesis clearly illustrates that the findings are systematic and consistent for different samples and using both cross-sectional and longitudinal design. Thus, health-relevant personality traits can be of importance in clinical practice, when interpreting results from health and psychosocial work environment assessments and when designing occupational health interventions.

*Paper I* addressed a health concern that has been sparsely investigated in relation to personality before. The most consistent finding was that negative affectivity was associated with clinical (ULL) and subjective (HQ) measures of hyperacusis. Naturally, it would be interesting to know if there are causal links between negative affectivity and hyperacusis. However, since Paper I utilized a cross-sectional design, there is no way to infer causality. It is plausible that both the psychosomatic hypothesis and the disability hypothesis partly explain these associations. According to the psychosomatic hypothesis, higher levels of negative affectivity would influence the progression of hyperacusis. Possibly, prolonged periods of anxiety, stress and distress could lead to an overall sensitivity and ultimately signs of hyperacusis. It is also likely that causality can be explained by the disability hypothesis. Distress and suffering that hyperacusis often entails may change an individual's personality to increase their level of negative affectivity. These dual mechanisms have also been discussed by others [140] but to my knowledge, no studies have used study designs that allow investigations of causality. It is also plausible that both these hypotheses are valid and interact.

Until causal links have been established, these findings can still be of clinical relevance. For clinicians, taking health-relevant personality into consideration when choosing treatment options may yield better outcomes for the patients. One way of achieving this would be to investigate possible co-morbidity, since individuals with higher levels of negative affectivity may also suffer from other health-related problems [68], but not necessarily seek treatment for them. Individuals with higher levels of negative affectivity who seek treatment for hyperacusis may also benefit from additional support, such as more regular follow-ups and emotional support. This might also increase adherence to the treatment. Thus, these findings highlight the probable need to take personality into consideration in the clinical work for optimal patient outcomes.

The findings in *Paper II* is supported by previous research reporting that personality is associated with perceptions of the psychosocial work environment and leadership [6, 7, 9, 90, 92, 94-96, 141]. The correlations were weak, implying that health-relevant personality traits

play a role, but only explain a small proportion of the variance in perceptions of the psychosocial work environment and leadership. The findings may be of practical importance, for example when leaders assess results from questionnaires. Knowing that personality influences the perceptions of psychosocial work environment assessments may prepare them for what to expect and facilitate their interpretation of them [94]. Leaders can expect overall better ratings in a workgroup consisting of individuals with higher levels of hedonic capacity. Similarly, they can expect worse ratings in workgroups where the majority exhibit higher levels of negative affectivity. In extension, this suggests that the results in one workgroup may not always be comparable to another. For example, individuals might respond to a question about how satisfied they are with their immediate superior on a scale ranging from 1 (very dissatisfied) – 5 (very satisfied). For an individual with high negative affectivity, selecting the response alternative 3 might reflect a good rating, whereas the same number might reflect a poor rating for someone who is highly hedonic. This way of reasoning implies that results are relative. A proper dialogue between the leader and the employees could help to establish that the results are interpreted correctly.

Thus, considering the influence of personality when interpreting results from questionnaires adds another dimension and complexity to these kinds of assessments. Questionnaires are common ways to assess the psychosocial work environment [98]. It is therefore important to make sure that a proper interpretation of the results is obtained.

*Paper III* found associations between health-relevant personality and adherence to a web-based occupational health intervention. More specifically, higher levels of antagonism and impulsivity were associated with fewer logins, and higher levels of impulsivity were associated with less time spent in the intervention. These findings are of importance for intervention designers and for those responsible for implementing an intervention. Individuals who are highly impulsive or antagonistic might for instance be more adherent if the intervention included motivational components. Furthermore, higher levels of negative affectivity were positively associated with utilization of self-help exercises. Considering that the exercises previously have showed beneficial effects [137], it is valuable to better understand why, for whom and under which circumstances. According to Batterham et al. [142], individuals who experience beneficial effects from an intervention are more motivated to be adherent. Since individuals with higher levels of negative affectivity and neuroticism generally tend to perceive poorer health [2, 47, 53, 56], it is possible that they are more motivated to utilize the self-help exercises to improve their health or perhaps alter aspects in their personality [143, 144]. Thus, a better understanding of the characteristics of those who utilize an intervention is important for more optimal outcomes.

In *Paper IV*, repeated measures of health, well-being, stress and aspects of the psychosocial work environment were investigated. Health-relevant personality traits were found to partly explain the development over time in the assessments. Most consistently, baseline negative affectivity moderated the development over time regarding concentration ability, energy, sense of control, job satisfaction, work atmosphere and social support. The findings highlight



the importance of personality as moderators of change in health, well-being and psychosocial work environment indicators over time. Furthermore, health-relevant personality traits predicted individuals' typical ratings of health, well-being and psychosocial work environment indicators. For example, individuals with higher levels of hedonic capacity typically rated better health, well-being and psychosocial work environment and those with higher levels of negative affectivity typically had poorer ratings. These findings are in line with several other studies [2, 3, 6, 9, 10, 42, 47-50, 53, 55, 92, 93]. Our findings illustrate that typical ratings of workload, but not stress, were positively predicted by hedonic capacity, whereas typical ratings of stress, but not workload, were positively predicted by negative affectivity. This suggests that workload and stress are two multidimensional variables and high workload does not necessarily have to be related to high stress levels. For some, high workload can rather be something positive, when combined with other variables such as good health, high energy, social support and job satisfaction for example. This information can be useful when assessing survey responses of workload and stress to better understand what they represent. More accurate interpretations of workload and stress need to account for individual differences and other health and well-being indicators.

Visualization of the data depicted clear seasonal variations in the responses – most health and well-being indicators increased in the summer time and decreased in the fall. Most psychosocial work environment indicators naturally decreased during the summer and increased in the fall. This finding highlights the relevance of also acknowledging seasonal variations when planning to distribute questionnaires and when interpreting the results. If a questionnaire is distributed in October – November, the outcomes may be worse compared to when the same questionnaire is distributed in August, for example. The results may depict natural variations and transient situations. If action plans and interventions are planned and implemented based on the results from such a transient situation, they may be perceived as unnecessary or irrelevant. There is surprisingly little research about seasonal variations in survey responses within the occupational health field. The studies that are available have found seasonal variations in stress, energy level [145] and in happiness [146]. Although sparsely investigated, the findings in Paper IV clearly indicate that there are seasonal variations in responses, which should not be discarded easily.

In conclusion, the papers in this thesis contribute with systematic findings in different populations, indicating that health-relevant personality traits play a role. Some of the results are well in line with previous research. The present thesis sheds light on nuances within personality research that has not been vastly studied before. Specific health-relevant personality traits have not been extensively investigated in this way previously.

When interpreting the results from Papers I – IV, it is important to consider that low levels of hedonic capacity are not the same as high negative affectivity, since they represent two different constructs. It is possible for individuals to score higher levels of hedonic capacity and higher levels of negative affectivity simultaneously. It is plausible that the combination of personality traits is relevant to investigate, in addition to investigating them separately. For

example, the combination of higher levels of negative affectivity together with higher levels of antagonism, impulsivity, alexithymia and lower levels of hedonic capacity may reveal different associations compared to when assessing the personality traits separately or in other combinations. Investigating patterns and combinations of personality traits based on the FFM has become more common during the last two decades [147]. This approach, referred to as a person-centered approach, is conceptually different from the more traditional way of analyzing personality variables that focuses on differences between individuals. The person-centered approach instead aims to identify subgroups based on patterns and combinations of personality traits within an individual. Both approaches may yield valuable information and complement each other [147, 148]. Since the person-centered approach is relatively new and has not yet been applied on health-relevant personality traits, it could be an approach for future studies to investigate.

Another aspect to consider is that each personality trait may have both upsides and downsides. For example, traits that are commonly perceived to be less advantageous in relation to health, such as high levels of negative affectivity or neuroticism, may sometimes be good. Higher levels of these traits might make an individual notice disease symptoms at an early stage and seek medical treatment for it [2]. Similar upsides and downsides have also been found regarding work-related behaviors [36]. The trait conscientiousness, to which impulsivity in HP5i is inversely related, is commonly associated with advantageous attributes such as being dependable. Highly dependable individuals typically work well with others and perform well at work [36]. However, being too dependable has been found to be unfavorable in certain situations. Highly dependable individuals can have difficulties in adapting to necessary changes in the work environment [149]. Thus, a certain level of a trait, may be advantageous in some ways and in some circumstances, and less advantageous in others.

## **6.1 PRACTICAL IMPLICATIONS**

The findings in all papers in this thesis suggest that interventions could be adapted or tailored to suit individuals' needs, expectations, motivational and learning styles. In practical terms, this could mean that intervention designers might need to include several pedagogical formats and components that individuals can choose from. Certain individuals may need multiple motivational components in order to be actively engaged in the intervention, whereas others do not. Since individuals differ, there is most likely no one size fits all intervention. Therefore, providing individuals with the opportunity to select from different pedagogics and components may be perceived as more meaningful and relevant for those targeted by the intervention.

The present thesis found associations between health-relevant personality traits and perceptions of the psychosocial work environment – studied both cross-sectionally and longitudinally. Although some of these associations were weak, they were systematic and consistent. The systematic pattern implies that health-relevant personality traits should be taken into account in this context, since they seem to be involved in work environment perceptions. However, since the associations were relatively weak, the impact of health-

relevant personality traits should not be overestimated. These findings can be valuable for leaders when assessing survey results and encourage them to better understand what the results mean. For instance, high job satisfaction for some individuals may entail high workload, whereas for others, it entails low workload. Differences in perceptions could be better understood through dialogue where the employees actively participate and explain how they interpret the questions. This is also an opportunity for active employee involvement in addressing possible areas that are relevant and meaningful to sustain or improve.

Finally, considering seasonal variations as well as individual differences in survey responses can be valuable. This may reduce the risk of misinterpreting the results, either by underestimating or overestimating them. If the survey responses are interpreted correctly, there is a better chance of creating prerequisites for implementing relevant interventions based on real needs. This knowledge can be used by organizations, leaders, researchers and for those responsible for designing and implementing occupational health interventions.

## **6.2 METHODOLOGICAL CONSIDERATIONS**

As with most research, there are methodological aspects that need to be addressed.

### **6.2.1 Measures**

The HP5i was used in all papers in this study, and there are both advantages and disadvantages that can be highlighted. Utilizing the same personality inventory in all papers is an advantage since it is possible to compare the findings in this thesis. On the other hand, choosing a specific inventory such as the HP5i limits the possibility to compare the present findings with previous studies that have used different inventories. The multitude of personality inventories available makes it difficult to select which one to use, and the advantages and disadvantages should be carefully considered before making a selection. In the three data collections, the rationale for choosing HP5i were partly guided by feasibility and the overall objectives of the studies. Utilizing an extensive and broad personality inventory was not practically possible. The 20-item HP5i was assessed together with approximately 200 –300 other variables in all three data collections. A plausible risk with utilizing lengthy personality inventories in general is that participants may refrain from filling out the questionnaires, or become fatigued and not complete them [36, 150]. Thus, these practical aspects partly guided the choice of personality measures. Moreover, the HP5i has overall acceptable psychometric properties with regards to internal consistency, which is an important aspect to consider.

In Papers I, II and IV, the health-relevant personality variables were trichotomized to depict those with high, medium or low levels of each personality trait. There are both advantages and disadvantages with such an approach. By trichotomizing a continuous variable, variation within that variable is removed and not taken into consideration in the analyses. On the other hand, categorizing variables in to high, medium and low levels is pedagogic and easily comprehensible. Since all analyses revealed systematic findings, using both trichotomized and continuous variables might have been a strength pedagogically, to more clearly illustrate

patterns. Similar patterns will appear even when different approaches are used, which is corroborated by the results.

A strength in Paper I was the use of both clinical and subjective measures of hyperacusis, since both have their strengths and limitations. The emotional dimension in the Hyperacusis Questionnaire (HQ) has been found to be correlated with measures of emotional exhaustion [151]. One of the measures of the HQ is similar in phrasing to one of the items in the HP5i. This might partly have influenced some of the associations between HQ and negative affectivity, but most likely only had limited impact since the findings with both the uncomfortable loudness levels (ULL) and HQ were systematic. A strength with the HQ is that it aims to capture behavioral dimensions of hyperacusis that are not possible to assess with clinical measures. It is likely that a low tolerance to sound impacts individuals differently, but this aspect is not possible to assess with ULL. Some individuals may experience more problems with emotional or social aspects, whereas others experience more problems with attentional aspects or all three. A possible limitation with using pure tones for assessing ULL is that individuals may be sensitive to other sounds than pure tones. For example, the sound of cutlery or speech may yield different outcomes than pure tones [140]. This means that an individual might suffer from hyperacusis, but a ULL test with pure tones might fail to detect it. Thus, combining clinical and subjective measures is an advantage for increasing the chances of a proper assessment both scientifically and clinically.

In Paper II, the employees' perceptions of leadership behavior and managerial support were investigated. This might raise questions as to how the leaders actually behaved. One approach for future studies might be to include several measures of leadership and support, such as how the managers are perceived by peers and by their superiors. On the other hand, a strength regarding the measures was the use of the satisfaction dimension in addition to the frequency dimension. One strength of using the satisfaction dimension is that the raters themselves express whether aspects in the psychosocial work environment are good or bad. This is valuable since there might be preconceptions that distort the interpretation of some ratings. For example, some individuals might be satisfied with often receiving support from their immediate superior, whilst others might be dissatisfied with it.

Using database logs as direct measures of adherence in Paper III is a way to limit the risk for social desirability confounding the responses. This bias occurs in situations when participants over- or underestimate self-ratings if they believe that adherence is desirable [1]. This bias is most likely reduced when using database logs as opposed to self-ratings. On the other hand, the database logs may entail other sources of bias. For instance, an individual might log in to the web-based intervention and be distracted or forget to log out. The individual would in such a situation appear to be logged in, when in fact the individual is not actively engaging in the intervention. However, an individual was automatically logged out after 20 minutes when the session ended. So even if this occurred, it would have yielded a negligible impact on the results. Paper III utilized the number of times an individual clicked on a self-help exercise as a measure of adherence. It would additionally have been interesting to investigate whether or

not the participants applied them in their daily lives. It is possible that the self-help exercises yielded learning effects if they were applied as intended. For example, individuals could have clicked once on an exercise and learnt a new method to improve the ability to prioritize among work tasks. The individuals could have applied this new skill in several situations once they learnt the method. Logging the utilization of the self-help exercises can be seen as a first step to assess adherence, and future studies could build on and investigate possible learning effects from utilizing the self-help exercises.

The HW-11 outcome measures utilized in Paper IV were all treated as single items. The benefits of using single items in organizational research has been highlighted in a meta-analysis by Fisher et al. [150]. The authors concluded that certain single items, such as for example job satisfaction can be valuable in some circumstances when multiple item measures are not feasible. An alternate approach however, could have been to investigate patterns of responses to all 11 questions instead of treating them as single items. It is plausible that the combination of certain variables, i.e., response patterns, could yield additional information. The combined pattern of, for example good self-rated health, high energy, control and concentration ability may possibly be more strongly associated with health-relevant personality traits than each variable separately. To my knowledge, this has not been tested before and could be an approach to further investigate these relationships.

### **6.2.2 Response rates, selection bias and generalizability**

In Papers II – IV, the selected participants constituted a relatively small proportion of the total samples. In Paper II, 754 individuals out of 2,519 invited participants were selected since they fit the inclusion criteria. In Papers III and IV, 563 and 517 individuals respectively were selected out of 2,090 invited participants. There is a potential risk of selection bias when conducting research, and this risk may have influenced the results in the Papers II – IV. This means that there is a risk that the participants included in these analyses may have had certain characteristics, e.g., particularly interested in health, work environment, stress management, etc. If selection bias exists, it could decrease the generalizability of the findings. However, the risk of this bias is still considered to be relatively low. In Paper II, the selected participants did not significantly differ regarding baseline characteristics compared to the total sample, which suggests that selection bias did not occur. In Papers III and IV such analyses were not made, but the distribution of personality traits was similar to other populations [46, 130]. In Paper IV, the risk of selection bias was considered to be relatively low, due to the large variation in all 11 outcome variables. The perceptions ranged from the lowest response alternative (0) to the highest (100), suggesting that there was no apparent selection bias in this sample. The sample was also considered to be representative since the distribution of one of the variables, self-rated health, was comparable with a national population sample [152].

### **6.3 ETHICAL CONSIDERATIONS**

As with all research studies there are a number of ethical considerations to address. The present thesis corroborates previous research that individual characteristics need to be further

understood and taken into account in practical terms. For instance, personality could be taken into consideration when planning and designing organizational interventions. This is to increase the possibilities and prerequisites to successfully target a variety of individual needs, expectations and motivators. In this way, interventions can be tailored in a way to be meaningful for all. This can be more ethically justified compared to implementing standardized interventions that perhaps only appeal to and reach certain individuals. Standardized interventions are undoubtedly implemented with the best intentions, but if they do not match the needs and expectations of the individuals, they might not be helpful at all. Furthermore, if expectations are not met and there is a low readiness for change, it can impact adherence negatively [118, 153]. Thus, it is important to properly understand the underlying expectations and needs before implementing an intervention.

There is a risk that the outcomes from this research could be used in a negative way. For instance, it is theoretically possible for individuals to misinterpret the results of this thesis and exaggerate the role that personality plays as a way to whitewash something else. Although personality plays some role, there are several other contextual and situational variables, etc. involved in these relationships as well. Misinterpreting or exaggerating the results could also potentially lead to discrimination or stigma towards those with higher vulnerability. This is however, clearly stated as unacceptable in The Swedish work environment act [154, 155]. According to this act, employment should contribute to health and individual satisfaction. The present research will hopefully be utilized in a way that facilitates better health and satisfaction for employees and organizations.

### **6.3.1 Blaming the victim**

The findings in Papers I, II and IV imply that negative affectivity is associated with poorer health, well-being and lower satisfaction with aspects in the psychosocial work environment. The risk of blaming the victim should be discussed in this context. Blaming the victim refers to the tendency to blame individuals for their own ill-health [1]. This is highly important in personality research in general and involves several ethical aspects. For example, blaming individuals with high negative affectivity for having poorer health, or for being less satisfied with the psychosocial work environment would constitute an ethical problem. One of the reasons why this research is important is to avoid victim-blaming to occur in the first place. The aim is to better understand why individuals with certain individual characteristics rate poorer health or more dissatisfaction with the psychosocial work environment so that their situation can be improved, if it constitutes a problem for them. For example, a regular dialogue between the employee and leader regarding health and aspects in the psychosocial work environment could be a way to increase the understanding of different needs, prerequisites and expectations. A better understanding of our differences can be a way to reduce the risk of stigmatization and instead create opportunities for good health and satisfaction.

## 6.4 FUTURE RESEARCH

Several broad and complex research fields have been addressed in this thesis and there are indeed several suggestions for future research based on Papers I – IV. It would be interesting to further develop alternative ways of analyzing combinations of health-relevant personality traits. Perhaps different patterns of personality traits combined would yield different outcomes and associations than have been found in Papers I – IV and in previous studies. For instance, are individuals with the combination of higher levels of negative affectivity and antagonism at greater risk for ill-health compared to those with higher levels of negative affectivity and hedonic capacity?

Study III found that health-relevant personality predicted adherence to the intervention used in that study, and it would be interesting to investigate other possible predictors. For example, which other contextual and health-related variables predict adherence to web-based health promotion and stress management interventions? Furthermore, it would be interesting to better understand the possible role of adherence for long-term outcomes and maintenance of an occupational health intervention. Are there differences in outcomes several years after an intervention between those who were more adherent compared to those who were less adherent?

Future studies could further investigate seasonal variations in occupational health assessments, since this is clearly an understudied area. A suggestion for future research is to examine if seasonal patterns differ between industries and between geographical areas. Furthermore, which outcome variables are more or less affected by seasonal variations? A better understanding of fluctuations and variability in occupational health measures could yield more accurate interpretations of them, as well as more correct and appropriate interventions.

## **7 CONCLUSIONS**

This thesis clearly, consistently and systematically demonstrates that health-relevant personality traits are associated with indicators of health, psychosocial work environment and adherence to an occupational health promotion intervention. The systematic findings corroborate and further strengthen previous research. Personality needs to be taken into account for optimal intervention adherence and outcomes. However, considering that some of the associations were relatively weak, the importance of personality should not be over- or underestimated. The present thesis has investigated several multifaceted and complex phenomena and there are no simple answers. However, there are practical implications. The results highlight the importance to assess and understand the interactions of health-relevant personality traits with health and the psychosocial work environment. For leaders, it can be important to better understand the differences in perceptions and that the same ratings can have different meanings for different individuals or groups of individuals. The relative meaning of results implicates that, for some individuals, high job satisfaction entails high workload, but not for others. Individual differences should also be considered when designing occupational health interventions so that these can be tailored and adapted to suit different needs, expectations, motivational styles and learning preferences. Thus, addressing health-relevant personality traits can be valuable in the systematic and continuous efforts to ensure good health and psychosocial work environment for all.



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