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THE WELL BALANCED ANAESTHESIOLOGIST

PERSONALITY AND STRESS IN
RELATION TO THE PROFESSION



RAYMOND VAN DER WAL

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RELATION TO THE PROFESSION



RAYMOND VAN DER WAL
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THE WELL BALANCED ANAESTHESIOLOGIST

Personality and stress in relation to the profession

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volgens besluit van het college voor promoties

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THE WELL BALANCED ANAESTHESIOLOGIST

Personality and stress in relation to the profession

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To our three children

Lillian Anise

Matilda Violet

And, in loving memory, William Paul

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CHAPTER

GENERAL INTRODUCTION, AIM AND
OUTLINE OF THE THESIS

1

GENERAL INTRODUCTION

BACKGROUND

In 1846, William Thomas Green Morton was the first to demonstrate the anaesthetic effects of ether. This finding was pivotal for the establishment of anaesthesia as a medical specialty. In retrospect, this initial demonstration of the effects of ether was the highlight of Morton's career because he did not succeed in further developing this finding himself. The reason for this failure was a troubled life, which was—in hindsight—probably caused by narcissistic and antisocial personality traits which ultimately developed into a pathological narcissistic personality.[1]

This historic example illustrates the importance of personality with respect to behaviour and, relatedly, performance. Good performance is important for anaesthesiologists, especially because anaesthesiologists are frequently confronted with patient related crisis situations. These are highly dynamic and complex, with potentially serious consequences. Undeniably these situations can be rather stressful. The intuition for such a job would be someone with a resilient personality, to be in balance with the demands required of an anaesthesiologist. This is in the short term important in for patient safety and in the long term for the well-being of the anaesthesiologist as well. For this reason, the question whether anaesthesiologists should be equipped with specific personality characteristics, to be a well-balanced person, is relevant and important.

The topic of this thesis will be the personality of anaesthesiologists in relation to the stressful nature of their profession.

THEORETICAL FRAMEWORK

Research into personality and stress requires a theoretical framework. This is important because the concept of personality is complex and has been studied from several perspectives. Additionally the term stress is abstract and is used in various contexts with different meanings. Furthermore, definitions of stress may reflect perspectives from the disciplines involved in stress research such as psychology, biology, physiology, neuroscience and medicine. For these reasons this section provides some background and a brief introduction of the concepts of personality and stress as they are used in this thesis.

PERSONALITY

Defining personality

Personality has been defined as the set of psychological traits and mechanisms within the individual that are organized and relatively enduring, and that influence his or her interactions with, and adaptations to, the intrapsychic, physical and social environments.[2] In other words, personality is regarded as a tendency to certain thinking, emotions and behaviour; under given circumstances. It is assumed that an individual's personality is stable over time and situations, while behaviour is a function of that personality in a given situation. Already in 1936, Lewin described this relationship in the formula: $B = f(P|E)$ where B stands for behaviour, P for the person and E his or her social or physical environment.[3] Hence, in principle, personality could be inferred from stable behaviour over time and behaviour (in a certain situation) could be predicted from personality.

Perspectives of personality

Personality has been studied from different perspectives. The psychoanalytic perspective (Freud) and humanistic perspective (Maslow) are well known examples. The perspective of personality used in this thesis is that of trait psychology. Trait psychology assumes that a personality can be described in a set of personality traits that are both necessary and sufficient. The psychologist Raymond Cattell was one of the first to use statistical methods (factorial analysis) to find and describe distinct personality traits.[4]

The trait approach to personality has been very successful and may be regarded as one of the major achievements of psychology.[5] To date, the Five Factor Model of personality (FFM) is the most established model of trait personality. With the FFM personality can be extensively described in the five mutually exclusive dimensions of Neuroticism, Extraversion, Openness, Agreeableness and Conscientiousness. [6] These traits are assumed to be relatively stable over the lifespan and culturally independent. Moreover, these five traits demonstrated to be of relevance in, amongst others, the domains of mental and physical health and occupational psychology. That is, they predict real world outcomes such as: happiness and well-being, psychopathology, physical health and occupational performance.[7]

STRESS

Defining stress

Broadly, stress is defined as the nonspecific adaptive response or reaction of the individual to any change, demand, pressure, challenge, threat or trauma to that individual.[8] To prevent conceptual confusion often a distinction is made between the stress response (effect) and the stressor (whatever causes the stress response). More narrowly, stress is defined as a process in which the stressor taxes or exceeds the adaptive capacity of the individual, i.e. the stress response is maladaptive, resulting in risks for health or posing a threat to wellbeing.[9] We realise that the debate how to define stress is nuanced and long-standing, however an in depth discussion is beyond the scope of this introduction.

Perspectives of stress

In stress theories both physiological and cognitive-behavioural perspectives are important because the stress response constitutes not only a physiological reaction but also a psychological reaction, consisting of cognitive, emotional and behavioural components.[10]

Early models of stress only emphasized the physiological stress response and as a passive process. Examples are the well-known fight-or-flight response, developed by Cannon in 1929, and the General Adaptation Syndrome introduced by Selye in 1946.[11, 12] In the physiological stress reaction several stress hormones play a role; within seconds after the onset of a stressor, catecholamines such as adrenaline ready the body and act via the central nervous system. In minutes to hours, glucocorticoids such as cortisol act via the hormonal route (HPA-axis) and support the activity of catecholamines.[13].

Concerning the psychological stress response, it was realized that the interaction between the stressor and the individual is not just a passive process but rather transactional; which supposes a dynamic relationship between the individual and the stressor. The leading cognitive-behavioral theory of stress became the transactional model, first developed by Lazarus and Folkman in 1984.[14] This theory assumes that two components of a single cognitive process take place simultaneously: In the primary appraisal the individual assesses demand; the stressor is either irrelevant, benign (challenge) or potentially harmful (threat). In the secondary appraisal it is decided whether perceived demands are balanced against perceived resources and how to cope.

However, because the stress reaction constitutes both a physiological and a psychological component it makes sense to regard them combined. After all, the physiological reaction supports the psychological components of the stress response: the person might experience increased muscle strength, changed perception of pain or fatigue and increased memory and focus can accompany feelings of anxiety or excitement.[15] A more recent model building both on Selye's work and on cognitive appraisal theories, is the concept of allostasis by McEwan, 1998.[16] Analogue to homeostasis (a concept also introduced by Cannon, in 1932), allostasis is about the stability of the individual. However, allostasis refers to the adaptation to change: in the presence of a stressor, processes activate to maintain a new equilibrium. When allostasis occurs frequently, is maintained or inadequate, allostatic load (cumulative physiological costs) occurs and disease may develop in time. Note that this model is consistent with the more narrow definition of stress: health related consequences of stress are an essential component of the concept of allostasis.

Stress response

The stress response has several phases: the initial stress reaction, adaptation and recovery.[17] Stress responses may be short or become chronic. In acute stress the duration of the stressor is relatively short, and the individual has time to return to baseline level of functioning.[18] In chronic stress the duration of the stressor is long, so there is a prolonged stress response without returning to baseline levels. Chronic stress can also be caused by consecutive shorter stressors which prevent the individual to recover from the initial stress reaction and to return to normal. [19] Chronic physiological stress increases the amount of catecholamines and glucocorticosteroids, which results in higher risk for hypertension, coronary artery disease, atherosclerosis, obesity and higher susceptibility to infections.[20] When negative psychological stress responses become chronic, this can lead to feelings of insufficiency, anxiety or depression and syndromes such as burnout may develop. Burnout is a syndrome caused by chronic stress and is constituted by emotional exhaustion, depersonalisation (social distancing) and feelings of insufficiency.[21] Furthermore maladaptive behaviours such as alcohol and substance abuse may manifest.

PERSONALITY AND STRESS

It is known that people differ widely in their stress response; in similar situations some individuals will thrive while others might decompensate.[17, 22] These

interindividual differences are central in transactional stress theories, not only when regarding the psychological stress response but also in relation to the physiological stress response.[23] In psychological research it is widely assumed that personality influences the stress response in several ways.[24]

In relation to stress, emotional intelligence is interesting because it is about how individuals process and utilize emotionally laden information with respect to themselves and with respect to others.[25] The use of the word intelligence might imply emotional intelligence to be a cognitive ability; however it is preferable to consider it as a personality trait: trait emotional intelligence (TEI).[26] Trait Emotional Intelligence (TEI) aims at gathering affect related traits that are scattered throughout the five dimensions of the FFM under one denominator and is thus consistent with trait psychology. TEI showed incremental validity in explaining a number of responses and emotional behaviors above the established FFM.[26, 27]

PERSONALITY AND STRESS IN ANAESTHESIA

Anaesthesiologists are generalists; they treat patients of all ages, who may be very healthy or present with significant morbidity for a wide range of procedures. For this reason they need to have a broad knowledge base and possess an arsenal of clinical skills. To safely manage each individual case, these skills and knowledge need to be accompanied by good non-technical skills, such as situational awareness, decision making and communication. In that respect anaesthesia is not unique, other specialties are generalists as well, such as general physicians or intensivists. However anaesthesia is also a hyperacute speciality: with or without warning and very quickly, situations may develop where survival or morbidity of the patient is dependent on the performance of the anaesthesia provider under time pressure. Again, also other specialties are confronted with life-or-death situations in hyperacute settings, such as gynaecologists or cardiothoracic and trauma surgeons. But, the combination of having to be a generalist and the possibility of unexpectedly having to use a subset of that broad general knowledge and skills to prevent disaster, constitute a lack of control over work pattern which is specific for anaesthesia.[28, 29]

Synthesizing the above: anaesthesia is a medical specialty with specific and profound stressors.[29, 30] These stressors will cause a stress response, physiologically and psychologically. This response can be perceived as positive or as negative, and coped with well or maladaptively. Prolonged or repeated stress responses (chronic stress) and/or maladaptive stress responses have negative consequences for physical and mental health.[31] There is a significant body in anaesthesia literature concerning

stressors[29, 30, 32-36], (physiological) stress response [37-43] and chronic stress related disorders such as burnout.[44, 45] In this literature anaesthesia is identified as one of the more stressful specialties. Despite this consensus however, studies are inconsistent whether anaesthesiologists are more stressed than other specialties. [29, 46, 47]

Personality is an important mediator in the stress response, and assuming that generally anaesthesiologists are confronted with the same occupational stressors, then differences in stress response between anaesthesiologists are likely caused by differences in personality. Interest in anaesthesiologists' personality has been shown in our literature already in the eighties and early nineties.[48-50] When stress in anaesthesia became a topic of interest in the mid-nineties[51] then the intuition that personality is probably important in handling anaesthesia related stress was formulated a few years later.[29] This suggested research into the emphasized relationship between personality, stressors, satisfaction and outcome correlates of chronic stress, such as burnout, has not been executed in anaesthesia.[52] Unfortunately the literature concerning personality in anaesthesia is fragmented, because over the years research into this topic has been in and out of vogue. Therefore there is no clear line of thought connecting the published papers resulting in an established ideal personality profile. Additionally, some measures used to quantify personality are now considered obsolete or are troubled by other methodological issues. Furthermore it is not yet clear how differences in personality between anaesthesiologists are reflected by differences in (chronic) stress response.

The topic of anaesthesiologist personality is relevant because personality may be an important predictor for anaesthesiologists' response to stress and therefore of subsequent health and clinical performance. Expanding knowledge may help in identifying those at risk of developing stress related health problems or aiding in resident selection. Good clinical performance, individually and as a member of the medical team, is extremely important because ultimately this all benefits the patient.

AIM AND OUTLINE OF THE THESIS

The general aim of this thesis is to identify those personality traits that are advantageous for anaesthesiologists, especially when confronted with occupational stressors. To meet this aim we have formulated several research questions. These are summarised in table 1.

		Chapter 2	Chapter 3	Chapter 4a	Chapter 4b	Chapter 5	Chapter 6
General aim	To identify and reflect on advantageous personality traits for anaesthesiologists	x	x		x	x	x
Question 1	What is the existing knowledge concerning personality of anaesthesiologists?	x		x			
Question 2	Is there a relationship between personality and stressor appraisal in anaesthesiologists?		x				
Question 3	How significant is the chronic stress response in anaesthesiologists?				x	x	
Question 4	Is there a correlation between personality and chronic stress response in anaesthesiologists?				x	x	

Table 1. Overview of research questions and chapters

Chapter 2 will systematically review the existing literature in order to answer the question of what thus far is known about personality of anaesthesiologists. Although several reviews of stress or stress related disorders in the context of anaesthesia have been published,[28, 44, 45, 53] no systematic review of studies into personality of anaesthesiologists has been done. Literature was included until December 2020.

Chapter 3 aims to answer the question whether there is a relationship between personality and appraisal of stressors in anaesthesiologists. In a cross-sectional study we will examine personality traits, occupational stressors, and also work satisfaction. Using cluster analysis we will explore whether personality profiles can be found in anaesthesiologists. Factorial analysis will be used to identify occupational stressors and satisfaction. We will explore differences in appraisal of the identified occupational stressors and work satisfaction, between the found personality profiles.

Chapter 4a will serve as an introduction to *Chapter 4b*. Here we will discuss the relationship between personality, stress and burnout. We will also briefly discuss strategies to alleviate or prevent burnout.

In *Chapter 4b* first we will assess the psychological chronic stress response in terms of burnout and general psychological health in Dutch anaesthesiologists. Secondly we aim to answer the question how personality is related to this psychological chronic stress response in anaesthesiologists. To this end we will explore the relationship between the big five personality traits and burnout, dimensions of burnout and psychological distress. Logistic regression techniques will be applied. We will study the same cross-sectional sample in Dutch anaesthesiologists we used in chapter 3.

Chapter 5 first will explore whether chronic stress is related to career phase; from the perspectives of effort-reward imbalance and chronic physiological stress in a sample of Dutch anaesthesiologists. Second it aims to answer the question whether chronic physiologic stress response is related to the trait emotional intelligence personality. Chronic physiological stress will be measured as hair cortisol concentration. Career phase will be measured in years of experience. We will use linear and quadratic regression techniques.

Finally *Chapter 6* will synthesize our work in a general discussion of our findings and their implications and provide future research perspectives. The thesis will conclude with an overarching conclusion.

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CHAPTER

PERSONALITY IN ANAESTHESIOLOGISTS; A SYSTEMATIC REVIEW OF THE LITERATURE

R.A.B. van der Wal, J. Wallage, G.J. Scheffer, J.B. Prins, E.
Bijleveld. Personality in anaesthesiologists,
a systematic review of the literature. *European journal of
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STRUCTURED ABSTRACT

Background: As a central part of their job, anaesthesiologists often have to perform demanding tasks under high-stakes conditions. Yet, some anaesthesiologists seem better able to deal with the demands of the profession than others.

Objectives: This review aims to answer the following questions: What are necessary or desirable qualities of an anaesthesiologists? Which personality traits or characteristics have been found in anaesthesiologists? How does personality relate to job performance and work stress among anaesthesiologists?

Design: Systematic review of studies that examined anaesthesiologists' personality or personality characteristics. We performed our synthesis in terms of the five-factor model of personality.

Data sources: The search was conducted in the Pubmed, EMBASE, and Web of Science databases. Literature was included until December 2020.

Eligibility criteria: We included qualitative and quantitative studies that examined anaesthesiologists' personality; also we included studies that focused on anaesthesiologists' stress, performance or mental health but only if these topics were examined from the perspective of personality.

Results: We included 6 qualitative and 25 quantitative papers. Synthesis of the qualitative papers revealed two classes of desirable personality characteristics; technical and non-technical. Synthesis of the quantitative papers suggested that anaesthesiologists do not essentially differ from other medical specialists. Moreover, our synthesis revealed several personality traits that predict good performance, low stress or good mental health among anaesthesiologists: lower Neuroticism, higher Extraversion, higher Openness and higher Conscientiousness.

Conclusions: Those personality traits that predict performance, stress or mental health in anaesthesiologists, also predict performance, stress or mental health in other (medical and non-medical) high demand/high stakes environments. The ideal anaesthesiologist would be lower on Neuroticism, higher on Extraversion and higher on Conscientiousness.

INTRODUCTION

Personality is defined as the set of psychological traits of a person that (a) are relatively enduring and that (b) influence how that person interacts with his or her environment. In line with this definition, behaviour is assumed to be a function of personality and circumstances.[1] In other words: personality describes tendencies to display certain behaviour, experience certain emotions, or have certain cognitions in given circumstances. As the psychologist Raymond Cattell put it, personality is: 'that which permits a prediction of what a person will do in a given situation'. The psychology of personality has several applications, e.g., in the domains of individualised education, targeted mental health prevention, and personnel selection.

It is a compelling intuition that specific jobs require specific behavioral tendencies.[2] For example, astronauts need to be psychologically resilient and flexible under the most extreme circumstances, while artists need to be creative.[3, 4] Anaesthesiologists, like other physicians, need to be able to stay calm and collected at all times, including when they are confronted with patient-related crisis situations. [5] If we assume that most anaesthesiologists face similar working circumstances, personality should be a key predictor of anaesthesiologists' behaviour and, thus, their performance. Moreover, anaesthesiologists' personality may have an impact on how they cope with intense work-related stress, and thus, predict mental wellbeing during their careers. So, anaesthesiologists need personality characteristics that empower them to adequately handle the high demand/high stakes nature of their job and the stress that comes with it.

To the knowledge of the authors, the personality of the anaesthesiologist in relation to their work and its implications on performance and stress have not yet been systematically reviewed. With this paper we aim to fill that void. First, we discuss qualitative studies to answer the question: What are the necessary or desired qualities of an anaesthesiologist? Second, we discuss quantitative studies to answer the following questions: Do anaesthesiologists differ in personality from the general population? Do anaesthesiologists differ in personality from other physicians? Does personality predict anaesthesiologists' performance? And: Does personality predict anaesthesiologists' mental health?

METHODS

The research questions and the methods were registered in PROSPERO (ID: CRD42020154863).

The search was conducted in the Pubmed, EMBASE, and Web of Science databases. We searched these databases for *personality* in relation to *anaesthesia*. Medical Subject Headings (MESH-terms) and keywords used for our search were: “Anesthesiology”[MeSH] OR “Anaesthesiology” OR “Anaesthesia” OR “Anaesthetist” OR “Anaesthesiologist” OR “Anesthesiologist” AND “Personality”[MeSH] OR Human characteristics[MeSH] OR “Personal characteristics” OR “Stress, Psychological”[MeSH] OR “Stress” OR “distress” OR “Burnout”. The last systematic search was conducted on December 31 2020. No time limit was set. Languages were limited to Germanic and Roman languages.

Study selection

After removing duplicates, two authors (RvdW and JW) independently analysed titles and abstracts and made inclusion decisions (see below). When in doubt, the full text article was obtained. Consensus was reached through discussion.

We included qualitative articles that reported research on anaesthesiologists’ personal qualities. We included quantitative articles that reported prospective or cross-sectional research on anaesthesiologists’ personality, provided that these studies used well-established psychometric instruments, either prospective or cross-sectional.

Exclusion decisions were made in three steps. In the first step, we excluded articles that were not related to anaesthesia as a medical specialty (e.g., studies about dentists and veterinarians). Also, at this step, we excluded studies whose subjects were patients or animals. In the second step, we excluded papers that reported research on non-physician anaesthesia providers, such as nurse anaesthetists and anaesthesia technicians. In the third step, we excluded papers that focused on stress-related states such as burnout or fatigue, but did not relate these states to personality or individual differences. The remaining articles were obtained in full text, and assessed for eligibility (by RvdW and JW, who worked independently) . Also here, consensus was reached through discussion. Comments on other articles, editorials, reviews, conference abstracts and letters to the editor were excluded.

Two authors (RvdW and JW) independently evaluated the included articles according using a data extraction form. For quality-assurance purposes, a third author (EB) reviewed a random sample of 5 articles using the same form. We searched for measures of personality, performance, stress and mental health. We assessed the quality of the articles using an appraisal tool for cross-sectional studies (AXIS), while also considering the guidelines for quality of psychological research.[6, 7] An interrater reliability analysis using a pooled Kappa statistic was performed.[8]

Synthesis of results and summary measures

The findings from qualitative studies were synthesized in a narrative way. Because of the heterogeneity of psychometric instruments used in literature, for quantitative studies it was not possible to pool data and to conduct a formal meta-analysis. Therefore we will relate the findings of those instruments to the Five Factor Model of personality (FFM) where this is feasible. When results were mixed, we refrained from drawing a synthesized conclusion. The FFM has become the dominant model of personality in psychological science. The five mutually exclusive, bipolar dimensions (i.e. traits) are: Neuroticism, Extraversion, Openness to Experience, Agreeableness and Conscientiousness.[9, 10] There is evidence that these FFM-traits predict real-world outcomes.[11] An explanation of the FFM-dimensions with examples of descriptors is given in Figure 1.



Figure 1. Dimensions of the Five Factor Model with examples of descriptors. The five dimensions of the Five-Factor Model are mutually exclusive and bipolar (i.e., they cover a high to low continuum). These five traits are widely assumed to be both necessary and sufficient to describe people’s personality.

Generally, there are two types of instruments that can be used to map people’s personality: First, there are instruments that use scales or dimensions to quantify personality traits that are derived from general theories of personality (or from more specialised models of individual differences). Second, there are instruments in which scales or dimensions are statistically derived using factor analysis. A main advantage of the latter approach is that it enables researchers to readily compare the outcomes of studies. The five-factor model (FFM) is a statistically derived model and thus has the advantage of providing a comprehensive framework of psychological traits. Correlations between other psychometric instruments and the FFM have been studied, the relevant ones for this review are given in Table 1.

Table 1. The Five Factor Model and correlations with relevant dimensions, or underlying facets, of other personality inventories

Dimensions of FFM					
Personality inventories*	Neuroticism	Extraversion	Openness	Agreeableness	
				Conscientiousness	
Catell's Sixteen Personality Factor Questionnaire [12, 14] (16 PFQ)	High-Low anxiety (.80) (C) <i>Reactive-Emotionally stable</i> (L) <i>Vigilant-Trustful</i> (O) <i>Apprehensive-Self assured</i> (Q4) <i>Tense-relaxed</i>	Extraversion-Introversion (.63) -(A) <i>Warm-Reserved</i> -(F) <i>Lifely-Serious</i> -(H) <i>Bold-Shy</i> -(N) <i>Forthright-Private</i> -(Q2) <i>Group orientated-Self-reliant</i>	Tough-mindedness-Receptivity (-.62) -(A) <i>Reserved-Warm</i> -(I) <i>Unsentimental-Sensitive</i> -(M) <i>Practical-Abstracted</i> -(Q1) <i>Traditional/Open-to-change</i>	Independence-Accommodation (-.34) (also relates .49 to Extraversion because of facet H) (E) <i>Dominant-Deferential</i> (L) <i>Vigilant-Trustful</i> (Q1) <i>Traditional/Open-to-change</i> (H) <i>Bold-Shy</i>	Self-control-Lack of restraint (.66) (also relates 0.50 to Openness because of facet M) (F) <i>Serious-Lifely</i> (G) <i>Rule-Conscious/Expedient</i> (Q3) <i>Perfectionism-Tolerates disorder</i> (M) <i>Practical-Abstracted</i>
Adjective Check List [20] (ACL)**	<i>Succorance</i> (.45) <i>Ideal self</i> (-.60)	<i>Achievement</i> (.56) <i>Dominance</i> (.87) <i>Change</i> (.58) <i>Abasement</i> (.80) <i>Self-Control</i> (-.85) <i>Self-confidence</i> (.77)	<i>Change</i> (.45) <i>Creative personality</i> (.61)	<i>Communnality</i> (.61) <i>Nurturance</i> (.92)	<i>Endurance</i> (.88) <i>Order</i> (.87)
Jackson's Personality Research Form [21] (PRF)**	<i>Affiliation</i> (.67) <i>Social recognition</i> (-.48)		<i>Harm Avoidance</i> (.39) <i>Endurance</i> (.41)	<i>Harm Avoidance</i> (.36) <i>Affiliation</i> (.48) <i>Autonomy</i> (-.71)	<i>Endurance</i> (.53)
Minnesota Multiphasic Personality Inventory[22] (MMPI)**	<i>Negative emotionality</i> (.60) <i>Psychoticism</i> (.30)	<i>Positive emotionality</i> (.59) <i>Aggressiveness</i> (.29) <i>Constraint</i> (-.31)		<i>Aggressiveness</i> (-.32) <i>Constraint</i> (.32)	

Personality inventories*	Dimensions of FFM				
	Neuroticism	Extraversion	Openness	Agreeableness	Conscientiousness
California Psychological Inventory [23] (CPI)	Independence (-.31) Self-control (-.33) Good impression (-.36) Well-Being (-.59) Intellectual Efficiency (-.31) Realization (Vector3) (-.41)	Dominance (.36) Sociability (.50) Social Presence (.36) Self-acceptance (.30) Introversion (Vector 1) (-.55)			Responsibility (.30) Achievement via Conformance (.37) Flexibility (-.37) Norm-Favoring (Vector 2) (.38)
Temperament and Character Inventory[24]	Harm Avoidance (.36) Self-Directedness (-.44)	Harm Avoidance (-.47) Reward Dependence (.44)	Self-Transcendence (.33)	Cooperativeness (.57)	Novelty Seeking (-.44) Persistence (.30)
Myers-Briggs Type Indicator [25] (MBTI)		Extraversion E (.69) Introversion I (-.46)	Sensation S (.52) Intuition N (.49)	Thinking T (.40) Feeling F (.40)	Judging J (.50) Perceiving P (-.41)
Bar-On's Emotional Intelligence Questionnaire [26] BarOn EQ-i:125***	Happiness Self-Regard Impulse Control Stress Tolerance	Assertiveness Optimism	Emotional Self-Awareness Flexibility Reality testing Independence	Interpersonal Relationships Empathy	Problem Solving Social Responsibility

Values between brackets represent the correlations between the relevant dimension or facet and the corresponding FFM dimension, based on literature. Please note this table is not exhaustive; it serves to aid general interpretation of the several instruments in terms of the FFM.

*Dimensions are in non-Italics, underlying facets are in Italics **Only for this review relevant dimensions are given. ***No correlations are given, the relations between BarOn EQ-facets and FFM dimensions are rather based on conceptual correspondence.

The traits of Catell's 16 personality factor inventory (Catell 16 PF) and of the Five Factor Model (FFM), are statistically derived by factor analysis. Although methodologically differently constructed, bottom-up vs top down and with oblique (not mutually exclusive ie sometimes overlapping) vs orthogonal dimensions, they both measure personality in five, roughly the same, general factors.[12-14] The Adjectives Checklist (ACL) and the Jackson Personality Research Form (PRF) were also created to measure general personality.[15, 16] The Minnesota Multiphasic Personality Inventory (MMPI) is an inventory conceived to identify maladaptive personality styles. The California Psychological Inventory (CPI) is related to the MMPI and shares certain items, but was created to describe personality with everyday concepts. The Myers-Briggs Type Indicator (MBTI) is an instrument based on Jungian theory of personality.[17] Cloningers's Temperament and Character Inventory (TCI) is conceived from a psychobiological theory.[18] BarON's questionnaire (BarON EQ-i:125) is meant to measure emotional intelligence.[19]

RESULTS

Study selection

The flow of papers is depicted in Figure 2. After removal of duplicates and articles in non-western languages, the search until December 2020 yielded a total of 3074 unique articles. After analysis per title and abstract, 107 papers remained for full text analysis. Following a manual search of the references, 4 more articles were added. Detailed full text evaluation resulted in 40 papers for data extraction and quality assessment. The interrater reliability was found to be Kappa=0,65 (95% CI 0.57-0.72). In total 6 qualitative and 25 quantitative papers remained for inclusion in our systematic review.

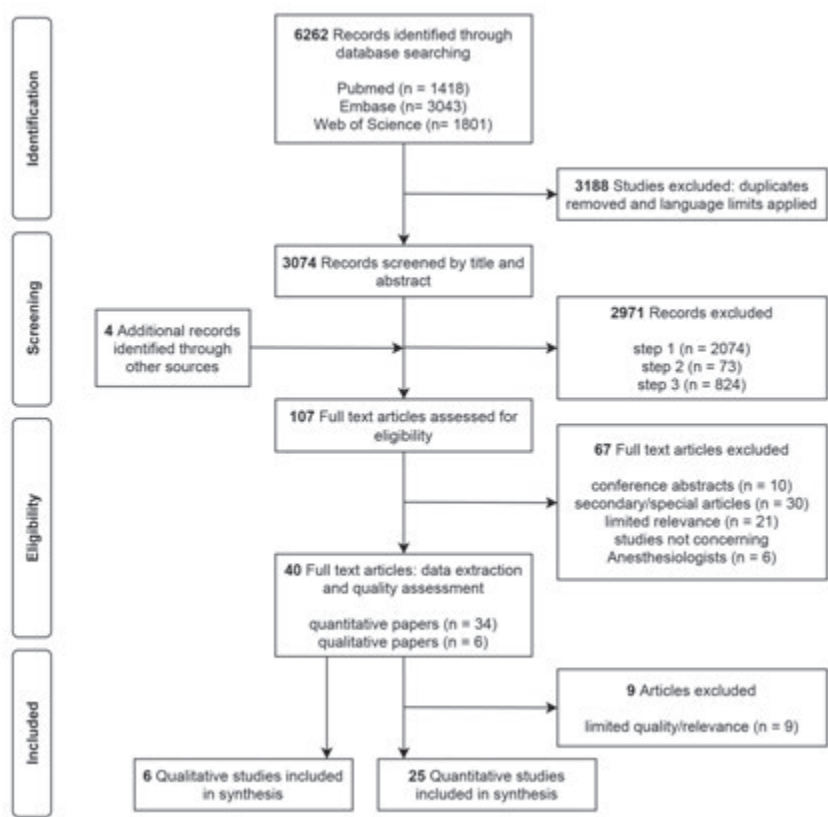


Figure 2. Flow of articles through the study.

Qualitative research (e.g. interview studies)

To answer the question which are necessary or desirable personality characteristics of an anaesthesiologist, questionnaires and qualitative research methods have been used. Qualitative research is ideally suited because it explores phenomena in the complex interactions between people and their environment.[27] The various qualitative research methods, which often involve in-depth interviews, have been previously discussed in our literature.[28]

Study characteristics

Most participants were consultant anaesthesiologists but residents participated as well. Also anaesthesia nurses—people who regularly observe anaesthesiologists’ behaviour—were asked to define excellence in anaesthesiologists. The studies used the (modified) Delphi method, focused interviews or questionnaires as their key methods. The results of the individual studies are presented in table 2.

Table 2. Characteristics of studies aiming to define desirable personality characteristics for the anaesthesiologist

Reference	Aim	Method, subjects and setting	Main outcome	Author conclusions	Limitations. <i>Italics=recognised by authors.</i> Not in italics= our appraisal
Kearney et al.[29] 2005, Canada	Identification of professional qualities for anaesthesiologists	Delphi method. 23 consultants from 16 academic residency programs.	Identification of three types of qualities: Humanistic (e.g. integrity, maturity, empathy), professional (e.g. self-awareness, commitment, accepting criticism) and meta-competencies (e.g. vigilance, decisiveness, pattern-recognition).	Specialty specific professionalism will be more clearly defined through identification of meta-competencies. Operational definitions of qualities need to be defined in terms of behaviour.	No inclusion of participants with possible different insights such as patients, residents or non-teaching staff. General conclusion seems fair.
Khan et al.[30] 2010, Pakistan.	Explore personality traits considered important for trainees anaesthesiology	Questionnaire. 28 personality traits were ranked by importance. 125 consultants from 46 faculties, response rate 79%. National survey.	Most desirable traits were: reliability, honesty, good functioning under stress, punctuality and discipline.	The reliability and predictive validity of these traits with respect to performance need to be assessed using structural behavioural interviews and personality testing. Working conditions between developing and more affluent countries may differ. General conclusion seems fair.	Non validated questionnaire, therefore possible differences in interpretation of the chosen traits.
Smith et al.[31] 2011, United Kingdom	Define excellence in anaesthesia and the role of personal qualities herein	Modified Delphi-type survey and focussed group interviews. 43 Consultants, 2 residents anaesthesiology. Nationwide.	Striving for excellence, originality, clinical skills highly ranked. Being efficient, caring, calm and alert lower ranked.	Superior knowledge and skills are fundamental but personal qualities and personality are essential for excellence. Most important personal quality defining excellence is the continuing urge to seek challenges and learn from them.	Framework needs further development No inclusion of participants with possible different insights such as patients General conclusion seems fair..

Reference	Aim	Method, subjects and setting	Main outcome	Author conclusions	Limitations. <i>Italics=recognised by authors.</i> Not in italics= our appraisal
Wong et al.[32] 2011, Canada.	Define distinct work elements and professional values in anaesthesia.	Individual interviews. 16 Consultants from a single residency program:1 academic and 4 associated hospitals.	A good anaesthetist is characterized by: clinical competence and personality traits (vigilant, detail-orientated focused and able to be calm in emergency situations). Also empathy and compassion are emphasized within the physician-patient relationship.	Typical anaesthetists are responsible, focused, controlled, practical and detail an action oriented. Particular values for anaesthesia are: goal-directed patient care, responsibility, control and humility.	Participants from only one program. Investigator is colleague, perhaps social desirable answers. Possible self-selection bias. Predominantly male sample. General conclusion seems fair.
Larsson et al.[33] 2013, Sweden.	Description of the way excellent anaesthesiologists act.	Focused group interviews. 18 very experienced anaesthesia- nurses. 4 hospitals, 5 departments	Six themes were found: structured, clear and informative, humble to the complexities of anaesthesia, patient- centred, keeping overview and calm and clear in critical situations. A social competent personality, but no special kind of personality.	The found themes showed overlap with the well-known ANTS-taxonomy. But, the excellent anaesthetist was described in terms of behaviour directed at fluency and safety in work by acknowledging the patient-centeredness of anaesthesia.	Gender imbalance, mostly female participants. Possible emphasis on pleasant work atmosphere. Valuable insights from those who have the regular opportunity to observe anaesthetists' behaviour
Gassner et al. [34]. 2020, Germany.	Identification and evaluation of essential personality traits for anaesthesiologists	Questionnaire adapted from Fleischman Job Analysis Survey: 28 personality traits were rated by importance. 251 residents/ 463 consultants anaesthesiologists. 232F/ 386 M. Online national survey.	The three personality traits rated highest were a high decision-making ability, stress tolerance and speed of perception. Furthermore, a high comprehension, affinity and patient-oriented behavior are needed.	For the anaesthetists high social interactive and cognitive personality traits are required.	Although a large number of responders the exact response rate is not known. General conclusion seems fair.

Synthesis of results

With regard to necessary or desired personality characteristics, we identified two themes. On the one hand, studies highlighted qualities related to cognition and intellectual capabilities; on the other hand, studies highlighted qualities that are related to personality. The ideal anaesthesiologist is capable of performing complex tasks. He or she recognizes potential problems in an early stage, because he or she has an eye for detail, while at the same time maintaining a bird's eye perspective. Moreover, the ideal anaesthesiologist is vigilant and practical.[29, 31-33] Professionally, he or she is self-aware, confident, socially competent, but accepts criticism (also from subordinates), and strives for excellence.[29, 31, 33] Emotionally, he or she is in control, alert and calm, and communicates with clarity, especially in critical situations, and is compassionate and emphatic.[29-34] Having good relationships with patients and being altruistic were sometimes lower ranked than good clinical skills.[29, 31, 34] However, in these studies, it is also often recognised that the patient is the centre of the anaesthesia universe.[32, 33] A shift in emphasis is noticeable in the literature: from the focus primarily on clinical skills and intellectual capabilities, to the recognition that superior clinical skills and knowledge may be fundamental, but that personal qualities are essential.[31]

Quantitative research (psychometric studies)

To answer the question which personality traits have been found in anaesthesiologists one should keep in mind that several methods can be used to assess personality. These methods include (experimental) behavioural observations or diagnostic interviews by psychologists. However for practical or statistical reasons self-report questionnaires are often used. These questionnaires have been validated by assessing their convergence with other measurements of personality, such as reports by others.[35, 36]

Study characteristics

Sample sizes ranged from 22 to 655 subjects of consultant and/or resident anaesthesiologists. To assess personality several instruments were used (table 1). The results of individual studies are given in table 3.

Table 3. Characteristics of psychometric studies of anaesthesiologists' personality

Reference	Aim of personality research	Subjects, Setting and Psychometric instrument used	Main results	Conclusions	Limitations <i>Italics= by authors</i> Not in <i>italics</i> = our appraisal	AXIS-Quality score 0-20
Reeve [37] 1980. United Kingdom	1. Explore differences with general population 2. Relation to performance.	231 (171M/60F) anaesthesiologists. Of this group, 44 were peer assessed for performance. National survey, 6.6% of total. Cattell's 16 PFQ.	- Compared with general population: More Apprehensive and Tense. More Reserved Shy Serious and self-reliant. More Dominant. More Perfectionistic. - Compared to sample of general practitioners: More Reserved and Self-reliant. More Dominant. - Lower performance: less Emotionally Stable, more Apprehensive and more Tense.	-Two personality profiles found in relation to performance. -The identification of desirable personality characteristics has implications for selection purposes.	<i>More research needed on identification of valid performance criteria and testing predictors of performance. No comparison other specialities.</i> No corrections for multiple measures are done. Responder bias possible.	10
Bruce et al [38] 1983 USA	Explore differences with general population and with psychiatrists.	34 (28M/6F) residents anaesth. 29 (28M/1F) anaesthesiologists 31 (17M14F) resident psych. 29 (27M2F) psychiatrists Multi center, academic. Cattell's 16 PFQ.	- Compared with general population: Less apprehensive, more self-sufficient, less traditional. - Compared with psychiatrists: Less warm and sensitive. More rule conscious and perfectionistic.	-More similarities than differences in personality between specialties. -Just personality testing gives no ground for selection yet.	<i>A longer version of the test could have given additional sensitivity.</i> Selection bias. Small groups. No correction for multiple testing.	11

Reference	Aim of personality research	Subjects, Setting and Psychometric instrument used	Main results	Conclusions	Limitations <i>Italics= by authors Not in Italics= our appraisal</i>	AXIS-Quality score 0-20
Moro Boscolo et al.[39] 1985 Italy	Self-description of psychological profile in relation to a description of the ideal anaesthesiologist.	23 (13M/10F) residents anaesthesia 24 (16M/8F) anaesthesiologists. Single academic centre	-No significant differences with general population. -Profile of ideal anaesthesiologist: High in intellect, able to perform difficult tasks, is dominant, in self-control, self-aware and orderly but keeps emotional distance.	Anaesthesiologist who again would choose for a career in anaesthesia are in their reported personality profile closer to the perceived ideal.	<i>Small group but representative of academic anaesthesiologists.</i>	9
Breton-Marques et al.[40] 1985 Mexico	Exploratory study into personality of residents anaesthesia and its influence on patients	Adjective Check List. 60 (51M/9F) residents anaesth. 3 university hospitals. MMPI	- Overall normal psychological structure - About a third showed a tendency towards negative emotionality and an inclination into psychotic characteristics.	Patients report normal behaviour and functioning of residents despite possible psychopathological traits.	<i>Exploratory instead of diagnostic results.</i> Non validated questionnaire for patients used.	8
Flores-Maldonado; [41] 1985 Mexico	Explore differences with surgery and internal medicine	34 (28M/6F) residents anaesth. 14 (14M) residents surgery 11 (11M) residents internal medicine. Single center academic Jackson Personality Inventory.	Anaesthesiologist characterized by harm avoidance (low risk taking). Compared with surgeons: higher endurance and more social recognition.	Differences in personality between groups were found, but: more similarities	<i>The authors do not mention limitations.</i> Unclear inclusion. Small groups. To current standards obsolete questionnaire used.	9
Gough et al.[42] 1991 McDonald et al.[43] 1994 USA	Explore relationship personality and performance. Possible usefulness for selection purposes.	95 residents anaesthesia (79M/16F), follow up 3 years. Multi- center academic. California Psychological Inventory	Related to performance: Independence (0.26), wellbeing (0.24), Socialization (0.26), Achievement via conformance (0.20) and Empathy (0.20). Correlation coefficient between brackets.	Performance in an anaesthesiology resident correlates modestly with certain scales of the CPI. Possible predictive value in screening applicants for residency.	<i>The small proportion of female participants is mentioned as a limitation.</i> Performance measures not validated.	11

Reference	Aim of personality research	Subjects, Setting and Psychometric instrument used	Main results	Conclusions	Limitations <i>Italics= by authors</i> Not in Italics= our appraisal	AXIS-Quality score 0-20
Reeve; [44] 1993 United Kingdom	Explore usefulness of personality testing as an aid for selection purposes	Primary 635 applicants. 62 residents (101M/39F) followed up. Single center academic.	-Significant difference between accepted and non-accepted applicants: more self-confident, less anxious, more stable and less tense, more dominant. -Personality explains 44.8% of variance in performance. (emotional stable, relaxed and warm and socially bold.)	-Predictive validity of Catell's 16PF in selection. -Value of personality testing in combination with interview highly predictive.	<i>The authors do not mention limitations.</i> Bias in results by variance in quality of applicants available both ways. Might have influenced correlations. Few drop outs.	10
Clarke et al; [45] 1994 Canada	Exploration of personality characteristics and relation with job satisfaction	Catell's 16 PFQ 330 (265M/63F) anaesthesiologists Two anglophone Canadian provinces, RR 42.3%. Catell's 16 PFQ	-Compared with general population: More Emotionally stable, yet somewhat Apprehensive. More shy. More dominant yet sensitive and open to change, more serious. -Significant positive correlations between satisfaction and emotional stability and trust. -Female anaesthesiologist more insecure and apprehensive.	<i>Most anaesthesiologists were very satisfied with their work, especially when emotionally stable.</i>	<i>The authors do not mention limitations.</i> Possible responder bias not examined.	10
Suarez Delgado et al; [46] 1998 Spain	Explore personality characteristics compared with earlier research	22 (17M/5F) residents anaesth. 3 hospitals: academic and community, RR 50%. Catell's 16 PFQ	-Residents scored high in Reactivity, Self-Reliance and Traditionalism however no more than the general population. -Female residents less Anxious.	<i>The data obtained were similar to that described by Reeve and McDonald, both qualitatively and quantitatively</i>	-Groups compared are culturally different, different medical training programmes and selection processes -no parallel evaluation of technical skills and knowledge. Very small sample. Responder bias not examined.	12

Reference	Aim of personality research	Subjects, Setting and Psychometric instrument used	Main results	Conclusions	Limitations <i>Italics= by authors</i> Not in Italics= our appraisal	AXIS-Quality score 0-20
Reich et al;[47] 1999 USA	Prediction of performance from personality and cognitive abilities	67 (50M/17F) residents anaesthesia. Single academic center. Participation: 59% of total. California Psychological Inventory	Personality variables predicting poor clinical performance, based on supervisor evaluations, were: High on Introversion and on Flexibility.	Some personality measures are associated with clinical competence in a sample of anaesthesiology residents. These results should be interpreted with caution, but the conclusion seems fair.	<i>Clinical competence assessments are subjective. Incomplete enrolment. Data of non-participants is not available. Single center.</i> Focus on p-values rather than effect sizes. Many individual difference variables considering the sample size. Arbitrary cut-offs used for most variables.	15
Kluger et al;[48] 1999 Australia	Exploration of personality characteristics	167 (143M/23F) anaesthesiologists National survey, RR 33%. Catell 16 PFQ.	-Compared with general population more stable and confident, more practical and perfectionistic. -Sex differences: Females more relaxed, more tolerant. Males more Rule-conscious. -When higher on stability: more self-assured and relaxed, more warm and self-reliant, practical, rule conscious and perfectionistic.	-Traits appear common to all practitioners, and appear consistent with anaesthesiologists in other countries. Differences were most pronounced when comparing male to female practitioners. -Personality may be important in relation to performance under stress	-Failure to demonstrate differences in personalities may reflect deficiencies in the measurement tool. -Self-reporting bias Exploratory study. Focus on non-corrected p-values.	13

Reference	Aim of personality research	Subjects, Setting and Psychometric instrument used	Main results	Conclusions	Limitations <i>Italics= by authors</i> Not in Italics= our appraisal	AXIS-Quality score 0-20
Kluger et al:[49] 1999 New Zealand	Exploration of differences between anaesthesiologists and other physicians and non-physicians	222 (169M/45F/8?) consultant anaesth. (47M/7F/21?) resident anaesth. physicians other specialties: 67 (53M/10F/4?) Community sample (n=300) National survey. RR 71%. Temperament Character Inventory (TCI-125)	-Compared to community sample, specialist anaesthesiologists were more cooperative, self-directed but less reward dependent, novelty seeking and persistent but with an obsessive-compulsive personality style. -Compared with Physician consultants more cooperative. -Trainees vs specialist: novelty seeking and reward dependence (E) higher in trainees.	-Personality assessment has implications for recruitment, crisis management and professional development within anaesthesia. -Relationship personality with stressors and outcome needs to be further researched.	Possible responder bias not examined because of anonymity but probably non-significant due to high response rate. Exploratory study. Sex not known for all participants.	12
Cooper [50] et al. 1999. United Kingdom	Explore relationship between personality, stress appraisal and stress outcomes	564 (390M/174F) junior and senior anaesthesiologists. Nationwide survey, RR: 56.4% Type A personality traits.	Personality explained 15.9% of variance in job satisfaction. Personality and stressors explained 37.1 % of variance in mental health. Personality and stressors explained 29.8 % of physical health.	Type A-behaviour pattern not significantly apparent in anaesthesiologists, but related to stress appraisal and stress outcome.	Cross-sectional survey therefore no strict causal claims possible. Coping strategies not examined. We agree with the limitations	16

Reference	Aim of personality research	Subjects, Setting and Psychometric instrument used	Main results	Conclusions	Limitations <i>Italics= by authors</i> Not in Italics= our appraisal	AXIS-Quality score 0-20
Borges et al; [51] 2001 USA	Relating medical specialty to personality	51 (41M/10F) anaesthesiologists 52 (35M/17F) surgeons 59 (33M/25F) family practitioners (FP).	Anaesthesiologists are: -Less Tough Minded than surgeons more than FP. -Less Rule Consciousness than FP, same as surgeons. -Less Abstractedness than FP and Surgeon. -More Vigilant than GP's. Same as Surgeon. These three factors explained 5-10% of variance.	Support of theoretical framework of personality differences between technique orientated or people orientated specialties. Conclusions not completely supported by findings.	Limited inhomogeneous sample with regard to demographic and ethnicity. Only small amount of variance explained. Small sample. Low response rate.	13
Mitra et al; [52] 2003 India	Exploration of differences in personality between anaesthesiologist and surgeons	46 (33M/13F) anaesthesiologists 47 (41M/6F0) surgeons. Multi center. Response rate 46.5%.	No significant differences found in personality between anaesthesiologists and surgeons.	Counterintuitively, anaesthesiologists and surgeons in this study did not differ significantly in their personality. Due to limitations of study no further conclusions are pursued. Reasonable approach.	Small sample size. Possible responder bias. Exploratory study. We agree with the limitations.	14
Merlo et al; [53] 2009 USA	Explorative differences between high and low performing anaesthesia residents.	26 (M/F=?) residents anaesth. Single center. Version of Five Factor Model (BFM)	Compared with the low-competency group, individuals in the high-competency group scored significantly higher on cooperation, self-efficacy . and lower on neuroticism, anxiety, anger and vulnerability.	-In support of hypothesis that personality traits are associated with success in anaesthesia -Preliminary attempt to identify those factors.	Small effect size, unclear generalizability. Not corrected for multiple testing. Small sample. Performance measure subjective.	13

Reference	Aim of personality research	Subjects, Setting and Psychometric instrument used	Main results	Conclusions	Limitations	AXIS-Quality score 0-20
Schnell et al.[54] 2012 USA	Explore the association between resident personality type and performance.	36 (24/M12F) residents (of 46) Single-Center Academic, participation rate 78%. Meyer Briggs Type Indicator (MBTI)	<p>“Sensing” people higher supervisor ratings than “Intuition” people, on daily ratings and on global performance. Extraverts got higher global performance ratings (but not significantly higher daily ratings) than Introverts.</p> <p>-MBTI dimensions did not predict scores on the US Medical Licensing Examination.</p>	<p>Personality was not associated with resident performance on standardized measures of knowledge, but was associated with faculty assessment of resident performance.</p>	<p>The authors recognize the small convenience sample.</p> <p>The use of the MBTI (which forces people into dichotomies) and the sample size are major weaknesses.</p>	14
Talarico et al.[55, 56] USA 2008/2013	Determine whether Emotional Quotient (EQ) is associated with or predicts anaesthesia resident performance.	86 (48M/20F/9?) residents anaesthesia Multi center academic, RR 25%. BarOn Emotional Quotient Inventory the 125-item version (EQ-i:125)	<p>The research used supervisor ratings on the 6 ACGME-competencies*. Several aspects of EI were associated with several performance dimensions, with correlations around .30. EI was especially linked to ratings of patient care.</p> <p>NB. Preliminary study found no strong correlations.</p>	<p>The fact that total EQ correlates with all 6 core competencies suggests that the manner in which the resident is able to present her/himself enters into the total assessment of the resident's abilities.</p>	<p>1—Small sample; 2—Low response rate, 25%; 3—no correction for multiple comparisons; 4—the evaluation process at each individual institution has not been validated</p>	13
Van der Wal et al.[57, 58] 2016 Netherlands	Explore in anaesthesiologists -Relationship personality with stress appraisal -Relationship personality with burnout/stress	114 (53M/88F) residents anaesthesia 514 (335M/179F) anaesthesiologists National survey, RR: 35.5% Version of FFM	<p>-The most important personality trait influencing psychological distress and burnout was neuroticism.</p> <p>-Cluster analysis resulted in a distressed profile and a resilient profile. Job stress was significantly higher and job satisfaction was significantly lower in the distressed profile, compared with the resilient profile.</p>	<p>-In anaesthesiologists, personality traits are strongly related to the presence of psychological distress and burnout.</p> <p>-Personality profiles were found to be related to anaesthesiologists' experience of work-related stress and satisfaction</p>	<p>Psychometric validity of BarOn EQ is controversial</p> <p>Response rate low, responder bias. Cross-sectional design, therefore no strict causal claims possible.</p>	17

Reference	Aim of personality research	Subjects, Setting and Psychometric instrument used	Main results	Conclusions	Limitations <i>Italics= by authors Not in Italics= our appraisal</i>	AXIS-Quality score 0-20
Kisten et al.[59] 2018 South Africa	Relationship between personality traits and job satisfaction among anaesthesiologists	463 (267M/196F) anaesthesiologists National survey, response rate 31% Version of FFM	-Overall: Neuroticism and stability are in balance. Trend to extroversion, openness and agreeableness. Highly conscientious. -Lower job satisfaction in female anaesthetists, also higher neuroticism in female anaesthesiologists.	Neuroticism is strongest and most consistent negative correlate of job satisfaction. Agreeableness positively related to job satisfaction.	<i>Responder bias: Volunteer bias. Membership bias, FFM not fully representative, personality may change. Generalisability, representative control group other specialties needed</i>	14
Michelet et al.[60] 2020 France	Evaluate relationship personality and performance in an anaesthesia simulation.	36 residents anaesthesia (M/F not given) Single center study Version of the FFM.	Performance was modestly associated with conscientiousness (0.4) and agreeableness (0.35)	<i>Decision-making styles and personalities are involved in the successful management of critical situations during paediatric anaesthesia.</i>	<i>New validated technical skills scoring system. Scored by only one observer. Small effect size. No power calculated. Small sample size. No exploration relationship between decision-making style and personality.</i>	15
Van der Wal et al.[61] 2020 Netherlands	Explore relationship between emotional intelligence and physiological stress response	123 consultant (52M/71F) and 61 were resident anaesthesia (18M/43F).	Physiological stress as measured with hair cortisol concentration was not predicted by emotional intelligence.	Physiological stress response could not be explained from known sources of psychological stress	<i>Small sample and no control-group. Cross-sectional study, so no strict causal claims can be made.</i>	17

* Accreditation Council for Graduate Medical Education] core competencies (patient care, medical knowledge, professionalism, communication and interpersonal skills, practice-Based learning, and systems-based practice)

**Three sets of quantitative papers were combined because of usage of the same sample by the same research-groups. [42, 43] [57, 58] [55, 56]

Syntheses of results

In 1980, Reeve was the first to examine personality in anaesthesiologists, or any medical specialty for that matter.[37] After that, several initiatives followed. Anaesthesiologists' personality has been compared with the general population and with other specialties, under the assumption that, if differences in personality would be established, this could aid selection procedures. Later, the focus of studies shifted to the relationship of personality with performance or mental health. We categorised the studies by these aims. We interpreted studies in terms of the FFM, not in terms of the original instruments (Table 1; for a brief explanation of these instruments, see the caption of Table 1). However, for the sake of transparency, we do report the original instruments' dimensions or facets; these are *Italicised* in the text. The corresponding FFM-traits are Capitalised.

Do anaesthesiologists differ in personality from the general population?

Although some studies found that anaesthesiologists were higher on Neuroticism because they were more *Apprehensive* and *Tense* [37, 45], most studies found that anaesthesiologists were lower on Neuroticism because they were less *Apprehensive*, more *Emotionally stable* and more *Confident* [38, 45, 48], or more *Self-directed*. [49] Anaesthesiologists were lower on Extraversion because they were more *Serious*, *Reserved*, *Shy* or *Self-sufficient* [37, 38, 45] or less *Reward Dependent*. [49] Two studies found that anaesthesiologists were higher in Openness because they were less *Traditional*, more *Sensitive*, and more *Tolerant* [38, 45] It was also found that anaesthesiologists were lower on Agreeableness because they were more *Dominant* [37, 45]; however some suggested that anaesthesiologists should be higher on Agreeableness because they were more *Cooperative*. [49] Most studies found that anaesthesiologists were higher on Conscientiousness because they were more *Serious*, *Practical* and *Perfectionistic* [37, 45, 48] or less *Novelty seeking* [49]. One study found that anaesthesiologists were lower on *Persistence*, which might point to lower Conscientiousness. [49] Others found no evidence for differences with the general population, however these studies only reported rather small sample sizes. [39, 46]

In summary, taking into account sometimes contradictory findings, compared with the general population, anaesthesiologists were found to be lower in Neuroticism, lower in Extraversion, higher in Openness, higher in Conscientiousness, and not markedly different in Agreeableness.

Do anaesthesiologists differ in personality from other physicians?

Studies have compared anaesthesiologists' personality with general physicians, family practitioners, psychiatrists and surgeons.[37, 38, 41, 49, 51, 52]. Compared with general physicians or family practitioners some differences were found, for example anaesthesiologists were lower on Agreeableness because they were more *Dominant* [37] and less *Cooperative*[49]. However, other found differences were not consistent between those studies. When compared with psychiatrists and surgeons, papers concluded that there were more similarities than differences (i.e., even when between-group differences were statistically significant, and they often were not, the magnitude of these differences was usually small).[38] [41, 51, 52]

In summary, although some differences in general personality between anaesthesiologists and other medical specialists have been found, these were not consistent between studies. Furthermore, most studies concluded they identified similarities rather than differences in personality.

Does personality predict anaesthesiologists' performance?

When Reeve first studied anaesthesiologists' personality, a subgroup was peer-assessed on performance. In an exploratory fashion it was found that: Anaesthesiologists who performed better were lower on Neuroticism because they were more *Emotionally Stable*, less *Apprehensive* and less *Tense*. [37] In a later study Reeve found significant differences between accepted and non-accepted applicants: Accepted applicants were lower on Neuroticism because they were more *Self-Confident*, less *Anxious*, more *Emotionally Stable* and less *Tense*; and accepted applicants were lower on Agreeableness because they were more *Dominant*. When the accepted applicants were later assessed for performance, personality explained a fair proportion of variance: They performed better when they were lower on Neuroticism, because they were more *Emotionally Stable* and *Relaxed* and when they were higher on Extraversion, because they were more *Warm* and *Socially Bold*. [44]

Other researchers found comparable results: Better performance was predicted by lower Neuroticism, because more *Independence* and *Well-being* [42, 43] or lower *Anxiety*, *Anger* and *Vulnerability*, [53] By higher Extraversion, because more *Socialisation* [42, 43] and lower *Introversion*. [47] By higher Agreeableness, because more *Cooperation* [53], and by higher Conscientiousness, because more *Achievement via Conformance* [42, 43] and less *Flexibility*. [47] *Extraverts* (higher on Extraversion) got higher global performance ratings than *Introverts*, *Sensing*-people

(Higher on Openness) got higher supervisor ratings than *Intuition*-people, both on daily ratings and on a global performance score.[54] A complementary approach is the use of an instrument to measure emotional intelligence (EI). Several aspects of EI were associated with performance dimensions. *Self-Regard* and *stress tolerance*, corresponding to lower Neuroticism, *assertiveness and optimism*, corresponding to higher Extraversion and *Independence, Self-actualisation and Reality testing*, corresponding to higher Openness, were especially linked to ratings of patient care. [55, 56]

Anaesthesia simulations have proven to be an effective training tool, as documented by a well-developed literature. Because anaesthesia simulations closely resemble the real work, they provide an excellent opportunity to study performance as well. However, in this body of literature, only one study examined anaesthesiologists' personality. In this study, during anaesthesia simulations, performance was found to be positively related to Conscientiousness and Agreeableness.[60]

The studies on anaesthesiologists' performance described above used a range of approaches to measure performance (e.g., faculty ratings and peer ratings, for technical and non-technical skills, in both real-life and simulated settings). The measurement of anaesthesiologists' performance, and relatedly, the development of performance criteria, are topics of ongoing research.[62-65] However, despite the variety of approaches, the studies in this section show consistent results: Good performance was related to lower Neuroticism, higher Extraversion, higher Openness, and higher Conscientiousness. Overall, Agreeableness seemed to be somewhat less predictive.

Does personality predict anaesthesiologists' mental health?

The relationship between low job-satisfaction and mental health problems is plausible.[50, 66] An early study found significant positive correlations between Job satisfaction and *Emotional Stability* (lower on Neuroticism) and *Trust* (higher on Agreeableness).[45] It was also found in anaesthesiologists that exhibiting *Type A behaviour* was related to low job satisfaction and mental health.[50] Individuals with *Type A behaviour* are characterised as ambitious, competitive, impatient and aggressive or hostile. This is theoretically related to a combination of higher Neuroticism, higher Conscientiousness but lower Agreeableness. Indeed, in more recent studies where the FFM was used, lower Neuroticism, lower Introversion and higher Agreeableness were found positively related to job satisfaction.[58, 59] Concerning the physiological component of stress, the personality trait of EI was not

found to predict long term cortisol response.[61] With respect to burnout however, it was found that in anaesthesiologists personality traits were strongly related to the presence of distress and burnout, with Neuroticism as the most important correlate. Protective personality traits were Extraversion and Agreeableness.[57] Concerning general psychological health in resident anaesthesiologists, overall a normal psychological structure was found. However, about a third showed a tendency towards *negative emotionality* (higher on Neuroticism) and therefore at risk.[40] Although an older study, this number corresponds to incidences of burnout found recently.[67]

Summarizing, several studies looked into the relationship between personality and job satisfaction or mental health. Also here, the results are consistent: Higher Neuroticism is a risk factor for low job satisfaction and mental health problems, while higher Extraversion and Agreeableness seem to be protective.

Risk of bias

Several biases should be considered: Most studies were exploratory; some studies drew conclusions from relatively small samples and several studies focused on p-values rather than effect sizes. Moreover, p-values were not always corrected for multiple testing. More study participants were male compared to female, especially in the earlier studies. This changes in later studies, reflecting the M/F ratio in the current population of the anaesthesiologist workforce. Furthermore, there was a large timeframe over which studies were conducted. The quality of the older papers was not always to current standards. Moreover, most studies did not report a non-responder analysis. And importantly, the personality inventories were heterogenous and varied in quality. We will return to this issue in the limitation section of our discussion.

DISCUSSION

This is the first systematic review of the correlates of anaesthesiologists' personality. Qualitative research revealed generally two distinct sets of desirable personal qualities for the anaesthesiologist. The first set of desirable qualities can be described as *technical*, i.e., having skills and knowledge. The second set can be described as *non-technical*, i.e., especially when under stress having the ability to deploy the aforementioned skills and knowledge, having the will to excel, being a good communicator and genuinely empathizing with patients. These implicate a personality profile of the ideal anaesthesiologist: obtaining and maintaining the necessary technical skills should require higher Openness and Conscientiousness.

The desired non-technical skills should be associated with lower Neuroticism, higher Extraversion, and higher Agreeableness.

Quantitative personality research was done to examine the usefulness for personality-based selection processes and to examine the relationship between personality and mental health. Although some differences in personality between anaesthesiologists and physicians from other medical specialties have been found, findings suggest that anaesthesiologists' personality profile is similar to that of other physicians. Findings indicate that good performance is related to lower Neuroticism, higher Extraversion, higher Openness, and higher Conscientiousness. Agreeableness seems less important. From the perspective of low job-satisfaction and occupational health problems, higher Neuroticism is a risk factor, while higher Extraversion and higher Agreeableness seem to be protective.

Differences in personality compared with the general population.

The differences between anaesthetists and the general population likely exist because physicians, as a professional group, differ from the general population. A recent study where a large international cohort of doctors was tested using the FFM, found physicians lower on Neuroticism but higher in Extraversion, Agreeableness and Conscientiousness compared with the general population.[68]

Differences in personality compared with other specialties.

It is a common intuition among the medical profession that there must be differences in personality between medical specialties.[69] Physicians also like to exaggerate these supposed differences by jokes.[70, 71] However, meaningful differences in personality between specialties were not found.[51, 68] Perhaps, the psychometric instruments that are commonly used are not sensitive enough, but again, it is more likely that physicians share personality traits, regardless of their specialty.[68] Because behaviour is a function of personality *in given circumstances*, it is possible that any differences in behaviour of physicians of different specialties are due to differences in the work context, rather than to differences in personality.[72]

It has been suggested that personality testing could be a useful tool to match residents with specialties.[73, 74] However, it is also often emphasized that different personalities can succeed in the same specialty, and that there are many more factors than personality that determine specialty choice.[51, 73, 75] For these reasons, we question whether personality testing would be a helpful tool to aid early-career physicians with their choice of specialty.

Nevertheless, we believe personality testing in medical professions may be useful, but for different reasons. However, we emphasize that personality reflects merely a *tendency* to exhibit certain behaviours, experience certain emotions, or have certain cognitions in given circumstances. In other words: behaviours, emotions, and cognitions are not set in stone for any given personality.

Associations between personality, performance and mental health

First, personality predicts performance among anaesthesiologists: our synthesised findings indicate that good performance is related to lower Neuroticism, higher Extraversion, higher Openness and higher Conscientiousness. This is in line with literature from other disciplines. For example, a review found higher Conscientiousness predicting better performance in medical students. Later in medical training, Neuroticism and Agreeableness became predictive as well.[76] Similarly, surgery residents were found perform better when they were lower in Neuroticism, higher in Extraversion, and higher in Conscientiousness.[77] Finally, in orthopaedic residents lower Neuroticism and higher Agreeableness predicted better performance.[78]

Because anaesthesia is a high demand/high stakes profession, it makes sense to compare our literature with research about performance (when under stress) and personality from high demand/high stakes professions but outside of medicine. With respect to anaesthesia, an often-made analogy is that of aviation. Some have argued this analogy is overstretched and perhaps used by anaesthetists to co-opt some of the glamour that used to be associated with flying.[79] Still, we suggest the analogy is useful, not just because the phases of flight resemble the phases of anaesthesia, but also because. in aviation there is a large body of literature into personality characteristics and performance. Results are consistent with our synthesised findings, a meta-analysis of personality traits associated with success in military aviation programs showed a negative effect for Neuroticism and a positive effect for Extraversion.[80] However, one should keep in mind that correlations between personality and occupational performance are typically small to medium.[81]

Because of these modest correlations, during selection processes the value of personality testing to predict future performance is limited. If used at all, it should be considered in combination with other measures, such as measures of academic and cognitive performance. On the other hand, personality testing could be used to gain insight in one's weaker points, e.g., to in order to determine a specific training schedule to be used in a simulated anaesthesia environment.[82] Again by analogy to aviation, the value of simulation (team) training is beyond doubt in anaesthesia.

Personality testing could potentially be used to optimize team performance, by matching potentially complementary personalities.[83] The dimensions of the FFM that contain information about social interactions, especially agreeableness and extraversion, may serve as a starting point for future research.

Another reason why personality testing may be useful, is that it could potentially be used to identify individuals at risk for developing occupational health problems, with the aim to offer these individuals individualized support (e.g., through tailored continuing education).[84] [5] We hasten to add that work-related mental health problems should never be reduced to individual susceptibility, as it is well-established that unfavourable working conditions are a key cause of burnout.[67, 85] Thus, organisations are primarily responsible for providing healthy working conditions to their workers, to monitor these conditions, and if necessary, improve them.[85, 86] We nevertheless suggest that it is potentially useful to identify individuals at risk, because the stressful nature of anaesthesia can have negative consequences on mental and physical health in the long term.[67, 87, 88] A recent meta-synthesis provided evidence that personality predicts mental, and to some extent also physical, health.[89] Relatedly, another meta-analysis found significant relationships between personality and burnout.[84] That is, lower Neuroticism, higher Agreeableness and higher Conscientiousness and to a lesser extent higher Extraversion, are favourable. One should keep in mind that the latter relationships are complex and reciprocal: i.e. FFM-traits may predict (facets of) burnout, but burnout may also affect emotion-related aspects of personality.[90] With that said, the evidence from these previous studies is in line with what we found in anaesthesiologists.

There are several limitations concerning our review. First, because of the heterogeneity of the instruments used, we chose to interpret all results in terms of the FFM, which allowed to combine the findings of the reviewed studies in a meaningful way. However, the broad personality traits of the FFM possibly have too much bandwidth and provide too little fidelity, which are inversely related to each other (analogous to ultrasound, where a lower frequency probe will provide deeper penetration and a larger image, but with less detail).[91] Therefore, loss of nuance and detail of the individual studies was inevitable. However, to our best judgment, we believe that the advantage of using a common nomenclature of the FFM, which allowed us to synthesize results, outweighs the disadvantages. Second, the level of evidence of the included studies is medium at best. That is, most studies were exploratory instead of hypothesis-based and most studies were not pre-registered. Furthermore, most studies focused on statistical differences based on p-values which

were not always corrected for multiple testing. Nevertheless we believe that the consistent findings, despite that the studies used different personality questionnaires and outcome measures, triangulate convergent validity of these findings.

We have several recommendations for future research. First, being a model with a high resemblance to the real situation, anaesthesia simulation is not just a useful tool to foster professional growth but it is also a promising setting for research that aims to explore the relationships between personality and performance. Second, the FFM traits are meaningful but also rather general. For this reason research should aim at identifying more narrow predictors for specific outcomes that have incremental validity above the Big Five Model as a criterion.[11] Other personality constructs are of interest, such as for example Emotional Intelligence which when seen as a personality trait encompasses emotional related aspects from within several of the Big Five traits.[92, 93] Similarly, the construct of risk seeking or sensation seeking behaviour is potentially of interest. This trait has been hypothesized to predict the risk for substance abuse, a known occupational hazard for anaesthesiologists.[94-96]

Concluding, there have been substantial efforts to examine anaesthesiologists' personality, from several perspectives, for different aims, and with various instruments. Anaesthesiologists' general personality does not essentially differ from that of other medical specialists. Furthermore, those personality traits that predict good performance and good mental health in anaesthesia, also predict good performance and good mental health in other high-stakes/high-demand medical and non-medical environments. The ideal anaesthesiologist would be lower on Neuroticism, higher on Extraversion and higher on Conscientiousness.

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CHAPTER

WORK STRESS AND SATISFACTION IN RELATION TO PERSONALITY PROFILES IN A SAMPLE OF DUTCH ANAESTHESIOLOGISTS

R.A.B. van der Wal, M. J. Bucx, J. Hendriks, G.J. Scheffer, J.B. Prins. Work stress and satisfaction in relation to personality profiles in a sample of Dutch anaesthesiologists. *European journal of anaesthesiology* 2016; 33(11), 800-806.

STRUCTURED ABSTRACT

Background: Working in anaesthesia is stressful, but also satisfying. Work-related stress can have a negative impact on mental health, while work-related satisfaction protects against these harmful effects.

Objectives: How work stress and satisfaction are experienced may be related to personality. In this paper, the relation between personality and experience of work circumstances is studied in a sample of Dutch anaesthesiologists.

Design: Survey study.

Setting: Data was collected in the Netherlands from July 2012 until December 2012.

Participants: We sent electronic surveys to all 1955 practicing resident and consultant members of the Dutch Anaesthesia Society (NVA). Of those, 655 (33.5%) were returned and could be used for analysis.

Main outcome measures: The questionnaires assessed general work-related stress and satisfaction and anaesthesia-specific stress. A factor analysis was performed on the stress and satisfaction questionnaires. Personality traits were assessed using the Big Five Inventory (BFI). To identify personality profiles, a cluster analysis was performed on the BFI. Scores of the extracted factors contributing to job stress and satisfaction were compared between the profiles we identified.

Results: Our analysis extracted six factors concerning general job stress. Of those, the emotionally difficult caseload contributed the most to job stress. It also extracted four factors concerning general job satisfaction. Good relationships with patients and their families and being appreciated by colleagues contributed the most to satisfaction. The cluster analysis resulted in two distinct personality profiles: a distressed profile (n=215) and a resilient profile (n=440). General and anaesthesia-specific job stress was significantly higher and job satisfaction was significantly lower in the distressed profile, compared to the resilient profile. Experience of the emotionally difficult caseload did not differ between the two profiles.

Conclusions: Personality profiles were found to be related to anaesthesiologists' experience of work-related stress and satisfaction. One-third of the anaesthetists in our sample were categorised as distressed and are at risk for developing work-related mental health problems.

INTRODUCTION

Anaesthesia has its specific sources of stress, such as the need to act quickly, the long and irregular working hours, the acute nature of the job and having to deal with vitally compromised patients. In addition, there are general sources of stress, such as increasing hospital bureaucracy and safety rules. This has led to a higher workload, fear of litigation and less professional autonomy.(1-4) It is well known that high levels of work-related stress can have a negative impact on mental health, such as burnout syndrome or feelings of psychological distress. (5-8)

Anaesthesia is also accompanied by sources of satisfaction. Solving intellectually challenging problems, relieving suffering, getting recognition for your work and having good relationships with colleagues, patients and patients' families are important reasons why anaesthesiologists like their jobs.(9-11) High levels of work-related satisfaction are known to be protective against the harmful effects of work-related stress.(12-14)

Although all anaesthesiologists are generally confronted with the same sources of work-related stress and satisfaction, only some anaesthesiologists develop work-related mental health problems. It is likely that this difference is related to differences in personality.(15) This relation can be explained by the transactional theory of stress, which describes a dynamic process between stress, whether general or work-related, and the individual. When confronted with stress, an individual appraises the stressor as a threat, challenge or neutral event and then decides how to cope with it.(16) Another theory of stress, the dispositional theory, describes a relation between personality and experience of satisfaction.(17) In a previous analysis of our sample, we found a high incidence of psychological distress (39.4%) and burnout (18%). We found these mental health problems to be related to personality traits, the most important risk factor being the trait of neuroticism (emotional instability).(18)

Personality traits can be considered in isolation, but *a personality* consists not just of one personality trait, but of a combination of traits: a personality profile. These profiles can be identified through cluster analysis. Theoretically, many profiles are possible. Most researchers, however, report three to five profiles, depending on the group of people studied. The most important profiles that have been described in literature are the resilient, undercontrolled and overcontrolled profiles. Although these personality profiles are not entirely replicable and consistent across child and adult studies, they are convenient as labels summarising combinations of traits.(19-26) The terminology used to describe the personality profiles is based on the concepts of ego-resiliency and ego-control. Ego-resiliency refers to the ability to dynamically adapt to situational and

psychological demands. Ego-control describes the mechanism of impulse inhibition or expression. Overcontrolling tendencies lead to a rigid personality with restricted spontaneity and inhibition of creativity and interpersonal connection. Undercontrolling tendencies lead to unbridled impulsiveness. The well-adapted, resilient person is as overcontrolled as necessary and as undercontrolled as possible.(27, 28)

It seems obvious that personality profiles should meet the demands of the job. Unfortunately, personality profiles have not been studied in anaesthesiologists. Increasing our knowledge of the occurrence and performance of the various personality profiles might help anaesthesiologists to better cope with work-related stress and could be helpful in the selection of residents.

The objectives of this paper were to identify sources of stress and satisfaction in anaesthesiologists, to identify personality profiles in anaesthesiologists and to study the relation between the two.

METHODS

Approval for this survey was given by the local ethics committee (Commissie Mensgebonden Onderzoek regio Arnhem-Nijmegen, The Netherlands, no. 2012/148, April 2, 2012).

Participants

From July 2012 to December 2012, a total of 1955 electronic questionnaires were sent to consultant and resident members of the Dutch Society of Anaesthesia. Non-responders received a reminder after three months. The web-based programme RadQuest, developed by the Department of Medical Psychology and the Department of Instrumental Services of the Radboud University Medical Center, was used for the questionnaire.

Measurements

The questionnaire contained several psychological questionnaires. It also asked general sociodemographic questions such as sex, age, years practising as an anaesthetist, whether the respondent was a resident or consultant anaesthetist, and whether he or she was working in a community hospital or an academic centre.

Work-related stress and satisfaction

General work-related stress and satisfaction were assessed using the Hospital Consultants' Job Stress and Satisfaction Questionnaire (HCJSSQ).(29) We used a

version adapted for the Dutch situation.(30, 31) This questionnaire examines job stress and satisfaction conceptually, based on the work of Cooper, who identified 6 major sources of job stress (1. Job-specific factors, 2. Relationships at work, 3. Role in the organisation, 4. Career development, 5. Organisational structure and climate, and 6. Conflict between work and home life).(32) In interviews with consultants from various backgrounds the developers refined the questionnaire with good content and construct validity.(29) The questionnaire consists of 30 items concerning job stress, to be rated on an 8-point Likert scale (0: not applicable to 7: on a daily basis) and 18 items concerning job satisfaction, to be rated on a 5-point Likert scale (0: not applicable to 4: on a daily basis). The items can be found in supplement tables 1 and 2.

To assess specific anaesthesia-related stress, we used the items Rowbottom developed through interviews with anaesthesiologists.(9) The items can be found in supplement table 3. They were rated on a 7-point Likert scale (1: no source of stress to 6: most certainly a source of stress). The items were translated from English to Dutch by the author and a native-English-speaking consultant anaesthesiologist who also speaks Dutch, using a backward and forward translation method.

Personality

To describe personality, the Five Factor Model (FFM), also known as the Big Five, is the current standard in psychology.(33) The model distinguishes five bipolar personality traits which are found across individuals in different ages and cultures and are considered to be stable over time. To assess these five personality traits, we used a Dutch translation of the Big Five Inventory (BFI). The questionnaire examines the five traits in 44 items on a 5-point Likert scale.(34) The trait of neuroticism is opposed to emotional stability. It describes the tendency to experience negative emotions (8 items). Extraversion is opposed to introversion and concerns the tendency to seek stimulation from social situations (8 items). Openness to experience is opposed to being conventional or conservative and is about originality, independence, non-religiousness and having broad interests (10 items). Conscientiousness is the trait describing one's attitude to work, for example being reliable or irresponsible (9 items). The final trait, agreeableness, is opposed to detachment. It describes one's attitude to other people. Qualities such as love, empathy, friendliness and cooperation are associated with this trait (9 items).(35)

The internal consistency of the BFI in our sample was confirmed by Cronbach's α -values of 0.83, 0.81, 0.80, 0.76 and 0.74 for neuroticism, extraversion, openness to experience, conscientiousness and agreeableness, respectively.

Statistical analysis

An exploratory factor analysis was performed to test the underlying dimensions of (1) the stress items of the HCJSSQ, (2) the satisfaction items of the HCJSSQ and (3) the specific anaesthesia-related stress questionnaire. A principal component analysis (PCA) was applied as the extraction method. Orthogonal rotation (varimax) with Kaiser's criterion of Eigenvalues > 1.0 was used to determine the final number of extracted factors. The Kaiser-Meyer-Olkin (KMO) measure was used to verify the sampling adequacy for the analysis. In addition, Bartlett's test of sphericity was applied to test if the correlations between items were sufficiently large for PCA. The percentage of variance explained by each factor is presented. In addition, a confirmatory factor analysis was used on the five factors of the BFI. Cronbach's α was calculated as a measure of internal consistency of each factor. We did a hierarchical cluster analysis according to Ward's procedure to identify personality profiles based on the five factor model. Standardised scores (z-values) were used to characterise the identified clusters. One-way ANOVA was used to test the differences between the personality profiles in the sum score of each factor. The estimated mean group differences with the 95% confidence interval of the sum score of each factor are presented. All statistical analyses were performed using IBM SPSS Statistics 20.0 for Windows (SPSS Inc., Chicago, IL) and SAS 9.0 for Windows (SAS Institute Inc., Cary, NC).

RESULTS

Of the 1955 questionnaires, 655 (33.5%) were returned and analysed. The response rate was 34% for consultants and 28% for residents. In Table 1, the demographic characteristics of our sample are shown.

Table 2 presents the factors extracted from work-related stress and satisfaction scores, the observed values of the factors and the statistical characteristics of the factors. The observed values represent the relative importance of the extracted factors in terms of how they are experienced (scored). They are normalised to a 0-100 scale.

Table 1. Demographic variables of the studied sample

Total (n=655)		
Gender		
Male	388	(59.2%)
Female	267	(40.8%)
Age (year)	43.7	(26-64)
Experience (year)	12	(0-40)
Hospital		
Academic centre	295	(45%)
Community hospital	360	(55%)
Function		
Consultant	514	(78.5%)
Resident	141	(21.5%)

Data are numbers (and percentages) or medians (and ranges).

Table 2. The extracted factors of stress and satisfaction: observed values and statistical characteristics

Extracted factors of stress and satisfaction			Statistical characteristics			
	median	(25 th -75 th percentile)	Eigenvalues	% of explained variance (cumulative)	KMO-value* Bartlett's tests of sphericity	Cronbach's Alpha
General work-related stress (HCJSSQ):						
1. <i>Disruption of private life</i>	41	(32-52)	9.6	32.0	0.93	0.87
2. <i>Lack of support and participation</i>	38	(31-48)	2.1	39.0		0.80
3. <i>Having great responsibilities</i>	38	(26-47)	1.7	44.5		0.81
4. <i>Social/ external pressure</i>	36	(25-46)	1.4	49.3		0.73
5. <i>Problems in contact with other staff</i>	29	(24-33)	1.2	53.4		0.63
6. <i>Emotionally difficult caseload</i>	57	(48-62)	1.0	60.0		0.63
General work-related satisfaction (HCJSSQ):						
1. <i>Job certainties</i>	64	(54-75)	4.8	26.7	0.85	0.78
2. <i>Intellectual stimulation</i>	55	(45-70)	1.8	36.5		0.70
3. <i>Feeling appreciated</i>	81	(75-87)	1.4	44.4		0.58
4. <i>Good relationships</i>	75	(63-88)	1.0	50.4		0.67
Anaesthesia-specific stress						
1. <i>Specific demands of the job</i>	36	(20-54)	8.65	41.2	0.92	0.92
2. <i>Lack of support and appreciation</i>	33	(20-47)	2.04	50.9		0.84
3. <i>Organisational hassle</i>	44	(28-56)	1.30	57.1		0.72

The observed values represent the relative importance of the stress and satisfaction factors in terms of how they are experienced (scored). They have been normalised to a 0-100 scale; *KMO-value; Kaiser-Meyer-Olkin measure of sampling adequacy; Cronbach's alpha represents internal consistency.

In the HCJSSQ stress subscale, six factors were extracted with eigenvalues >1 . Factor 1: not being able to meet one's standards because work-related demands disrupt private life and spare time; Factor 2: lack of support and participation; Factor 3: having great responsibilities; Factor 4: social/external pressure; Factor 5: problematic relationships with other staff; Factor 6: emotionally difficult caseload. The most important source of general stress, in terms of scores, was being confronted with an emotionally difficult caseload (factor 6). From the HCJSSQ satisfaction subscale, four factors were extracted with eigenvalues >1 . Factor 1: having financial and job related certainties; Factor 2: being stimulated intellectually and developing professionally; Factor 3: being appreciated and contributing; Factor 4: having good relationships with patients and their families. The most important sources of general satisfaction, in terms of scores, were feeling appreciated and having good relations with patients and colleagues (factors 3 and 4).

From the anaesthesia-specific work-related stress questionnaire, three factors with eigenvalues >1 were extracted. Factor 1: specific demands of the job; Factor 2: lack of support and appreciation; Factor 3: having to deal with organizational hassle. The scores of all anaesthesia-specific stress factors were close, but organisational hassle bothers anaesthesiologists the most.

The factor loadings of the individual items for the HCJSSQ stress subscale, the HCJSSQ satisfaction subscale and the anaesthesia-specific stress scale are given in supplements 1, 2 and 3 respectively. Factor loadings express the relationship of each item to the underlying factor and can be interpreted like standard regression coefficients.

Figure 1 shows two personality profiles we identified with the cluster analysis on the personality traits measured with the BFI. Personality traits are expressed in z-values from the average. Z-values exceeding the range of $-\frac{1}{2}$ to $\frac{1}{2}$ were considered significant. Two distinct profiles were found. The first profile ($n=215$) shows a combination of high neuroticism, high introversion and low agreeableness. That means this profile is characterised by a tendency to experience negative emotions, low tolerance for stress, lower social engagement, lower energy levels and low concern with the well-being of others. It could therefore be described as distressed. The second profile ($n=440$) shows all traits to be in the normal range, indicating a resilient personality.⁽³⁶⁾ No significant differences in gender, age, working experience and type of hospital were found between the two profiles. We did find a significant difference concerning position: the proportion of residents is smaller in the distressed profile compared to the resilient profile (16% vs 23% respectively; χ^2 : 4.33, p-value: 0.04).

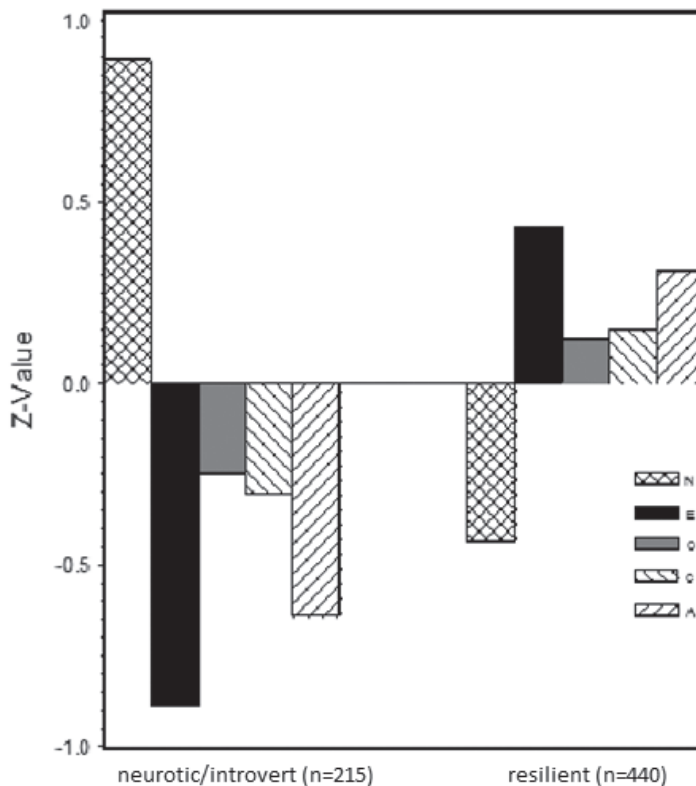


Figure 1: Personality profiles identified in anaesthesiologists. The +0.5 and -0.5 Z-values represent statistical significance. N: neuroticism; E: extraversion; O: openness to experience; C: conscientiousness; A: agreeableness.

Table 3 presents the observed medians (quartiles) of sumscores of the factors extracted from the HCJSSQ stress subscale, the HCJSSQ satisfaction subscale, and the anaesthesia-specific stress scale, all normalised to a 0-100 scale. The distressed profile scores significantly higher than the resilient profile on all but one of the extracted stressors: no significant difference was found in the factor relating to an emotionally difficult caseload. The distressed profile also scores significantly lower than the resilient profile on all extracted factors of HCJSSQ satisfaction. Concerning the anaesthesia-specific stressors, we again found significant differences between the two profiles. The distressed profile scores higher than the resilient profile on anaesthesia-specific sources of stress.

Incidence of burnout also differed significantly between the two profiles (40% vs 7.3% respectively; χ^2 : 104, p-value <0.001)

Table 3. Observed medians of work-related stress and satisfaction by personality profile and the difference between the two profiles

	Observed medians (quartiles) of the two personality profiles						p-value
	Distressed profile (n=215)		Resilient profile (n=440)		Estimated difference [#]		
	median	(25 th -75 th percentile)	median	(25 th -75 th percentile)	mean	(95%CI)	
General work-related stress (HCJSSQ)							
1. Disruption of private life	46	(36-57)	38	(30-48)	7.46	(5.21; 9.71)	<0.001
2. Lack of support and participation	43	(33-52)	35	(29-45)	7.42	(5.16; 9.70)	<0.001
3. Great responsibilities	41	(31-52)	36	(26-45)	4.70	(2.09; 7.30)	<0.001
4. Social/ external pressure	39	(29-50)	32	(25-43)	5.19	(3.42; 7.96)	<0.001
5. Problems in relationships with other staff	29	(24-38)	29	(19-33)	4.29	(2.64; 5.95)	<0.001
6. Emotionally difficult caseload	52	(43-67)	57	(48-62)	-1.44	(-3.70; 0.81)	0.210
General work-related satisfaction (HCJSSQ)							
1. Job certainties	61	(54-71)	68	(57-75)	-4.84	(-7.21; -2.46)	<0.001
2. Intellectual stimulation	55	(45-65)	60	(50-75)	-8.10	(-10.8; -5.40)	<0.001
3. Feeling appreciated	75	(69-88)	81	(75-88)	-6.18	(-8.11; -4.24)	<0.001
4. Good relationships	75	(63-88)	75	(75-94)	-6.01	(-8.97; -3.17)	<0.001
Anaesthesia-specific stress							
1. Specific demands of the job	46	(32-100)	30	(16-46)	14.7	(11.3; 18.1)	<0.001
2. Lack of support and appreciation	43	(27-60)	30	(18-43)	13.7	(10.6; 16.8)	<0.001
3. Organisational hassle	52	(36-60)	44	(28-56)	7.5	(4.4; 10.6)	<0.001

Values have been normalised to a 0-100 scale; HCJSSQ: Hospital Consultants' Job Stress and Satisfaction Questionnaire; (95%CI): 95% confidence interval;

[#] Distressed profile compared to resilient profile

DISCUSSION

To our knowledge, this is the first study relating work-related stress and satisfaction in anaesthesiologists to personality profiles. Significant differences in experience of stress and satisfaction were found between the two profiles we identified.

This study showed that the most satisfying aspects of anaesthesia are having good relationships with patients and their relatives and feeling appreciated by colleagues. An emotionally difficult caseload is the highest-scoring stressor. Organisational issues are also experienced as stressful by anaesthesiologists. The sources of stress and satisfaction we found are in accordance with previous studies. (1-4, 8, 9, 12, 37)

We identified two personality profiles in our sample of anaesthesiologists. The majority of anaesthesiologists were characterised as resilient. Because resiliency is related to competence, social intelligence and coping, a resilient anaesthesiologist is expected to respond flexibly to changing situational demands such as stress, conflict or uncertainty. This profile suits the challenges inherent in the practice of anaesthesia, and for that reason it is a profile we expected to find. Research shows that, of the big five personality traits, agreeableness and conscientiousness are the most valued by organisations.(38)

The other profile we identified was characterised by a tendency to experience negative emotions, lower social engagement, lower energy levels and low concern with the well-being of others. It resembles the personality known in literature as the D-type personality, with the tendency to experience negative emotions, to inhibit the expression of these emotions, and to avoid social contact. The D-type personality is a distressed personality prone to develop cardiovascular disease.(39) We chose to call this second profile we found the 'distressed' type, analogous to the D-type. We did not expect to find this particular profile among anaesthesiologists, because it had not been identified in literature concerning personality cluster analysis using the big five traits before.

Other studies often find not only the resilient profile, but also the profiles described as overcontrolled and undercontrolled. The overcontrolled profile is typically indicated by more than average emotional instability (neuroticism), being stimulated by social situations (extraversion) less than average, and by being concerned about work (conscientiousness) more than average. We would not have been surprised to find an overcontrolled profile because there are studies suggesting that anaesthesiologists are somewhat socially inhibited and preoccupied with their work.(40) The other common profile, the undercontrolled profile, is also

typically indicated by more than average emotional instability. This profile on the other hand is stimulated by social situations more than average and is concerned about work less than average. Its detachment from other people (the opposite of agreeableness) is more than average as well. This is a profile we did not expect to find in anaesthesiologists.

We consider the two profiles we found in the present study as distinct: in our distressed profile, the traits of neuroticism, extraversion and agreeableness differed significantly from the normal range, whereas in the resilient profile all traits were in the normal range. The two profiles assigned significantly different scores to stress and satisfaction. The resilient profile scored stress factors as lower in impact than the distressed profile, with the emotionally difficult caseload being a notable exception. Both profiles experienced the same stress from having an emotionally difficult caseload. Work-related satisfaction was scored significantly higher by the resilient profile than by the distressed profile. Because stress can have a negative impact on mental health, while satisfaction protects against these harmful effects, the distressed profile is more at risk to develop mental health problems. Indeed, analysis showed a significant difference in the proportion of burnout in the two profiles. A more stressful experience of work-related circumstances was linked to higher risk. For that reason, it may be advisable to assess personality profiles in the selection process of aspiring anaesthesiologists.

It is interesting that the experience of an emotionally difficult caseload, the highest-scoring source of stress, was independent of personality in our sample. One might expect the distressed profile to not be that touched by their emotionally difficult caseload, since they show lower social engagement and lower concern with the well-being of others. On the other hand, the distressed profile is more prone to experience negative emotions. That may be the reason they still experience such a caseload as emotionally difficult to handle.

Our study fills a void because there are few studies in health professionals relating personality, as measured with the five factor model, to work-related stress and satisfaction, and there are none in anaesthesia. Because we are the first to use the big five personality traits and the first to identify personality profiles in anaesthesiologists, comparing our results with previous studies is difficult. Only a few, older studies examined the personality of anaesthesiologists. The psychometric instruments they used are now considered obsolete.(41-43) In a sample of Canadian anaesthesiologists, for example, personality was examined with the Cattell 16PF Inventory and job satisfaction with a VAS-score. This study found a positive correlation between job satisfaction and emotional stability and a negative correlation between

job satisfaction and being suspicious and jealous and having unrealistic expectations. (44) A meta-analysis of studies relating the big five model to work-related satisfaction found correlations between job satisfaction and the personality traits of neuroticism (emotional stability), extraversion and conscientiousness.(17) This is in accordance with the results of our study.

A limitation of our study is the response rate of 33.5%. However, similar survey studies report response rates of 26.7-78%. (1, 9, 12, 13, 45-48). Our 33.5% response rate is similar to the mean response rate of 34.6% found in a meta-analysis of 56 internet-based surveys.(49)

Our conclusion is that personality is important in anaesthesiologists' appraisal of work-related stress and satisfaction. One-third of the anaesthetists in our sample are categorized as distressed and may be at risk for developing adverse work-related effects.

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Supplement 1. Factor loadings general work-related stress (HCJSSQ)

HCJSSQ stress items	Factors				
	1. Private	2. Support	3. Responsibilities	4. Pressure	5. Relationships
<i>Disruption of your home life through spending long hours at work</i>	0.71				6. Caseload
<i>Keeping up-to-date with current clinical and research practices</i>	0.51				
<i>Feeling under pressure to meet deadlines</i>	0.58				
<i>Having too great an overall volume of work</i>	0.61				
<i>Disruption of your home life as a result of taking paperwork home</i>	0.67				
<i>Disruption of your home life as a result of being on call</i>	0.63				
<i>Not enough time to pursue relaxing activities like sports and hobbies</i>	0.63				
<i>Having performance targets which are unrealistic or unattainable (e.g. due to lack of resources)</i>	0.45				
<i>Feeling you have insufficient input into the management of your unit or institution</i>		0.70			
<i>Having inadequate facilities (e.g. equipment, space) to do your job properly</i>		0.40			
<i>Encountering difficulties in relationships with managers</i>		0.63			
<i>Feeling that your accumulated skills and expertise are not being put to their best use</i>		0.46			
<i>Not being able to meet your responsibilities because of insufficient staffing</i>		0.32			
<i>Feeling lack of support and appreciation from your organisation</i>		0.63			
<i>Having to take on more managerial responsibilities</i>			0.39		
<i>Being responsible for the quality of the work of other staff</i>			0.63		

HCJSSQ stress items	Factors			
	1. Private	2. Support	3. Responsibilities	4. Pressure 5. Relationships 6. Caseload
<i>Being responsible for the welfare of other staff</i>			0.53	
<i>Having inadequate staff to do your job properly</i>			0.51	
<i>Having a conflict of responsibilities (e.g. clinical vs. managerial; clinical vs. research)</i>			0.47	
<i>Having conflicting demands on your time (e.g. patient care/ management/ research/teaching)</i>			0.53	
<i>Dealing with the threat of being sued for malpractice</i>			0.47	
<i>Uncertainty over the future funding of your unit/ institution</i>			0.57	
<i>Feeling pressure because of negative publicity</i>			0.57	
<i>Feeling compromised in professional autonomy by increasing quality-related litigation</i>			0.50	
<i>Encountering difficulties in relationships with junior medical staff</i>			0.36	
<i>Encountering difficulties in relationships with consultant colleagues</i>			0.48	
<i>Encountering difficulties in relationships with administrative staff, e.g. secretaries</i>			0.46	
<i>Being involved with the physical suffering of patients</i>			0.51	
<i>Having to deal with distressed, angry or accusatory relatives</i>			0.42	
<i>Being involved with the emotional distress of patients</i>			0.82	

NB: The numbers presented in this table are *factor loadings*, they express the relationship of each item to the underlying factor and can be interpreted like standard regression coefficients. HCJSSQ: Hospital Consultants' Job Stress and Satisfaction Questionnaire. Factor 1: not being able to meet one's standards because work-related demands disrupt private life and spare time; Factor 2: lack of support and participation; Factor 3: having great responsibilities; Factor 4: social/external pressure; Factor 5: problematic relationships with other staff; Factor 6: emotionally difficult caseload.

Supplement 2. Factor loadings work-related satisfaction (HCJSSQ)

HCJSSQ satisfaction items	Factors			
	1.Certainties	2.Stimulation	3.Appreciation	4.Relationships
<i>Feeling you have the staff necessary to do a good job</i>	0.53			
<i>Having a high level of autonomy</i>	0.41			
<i>Feeling you have adequate financial resources to do a good job</i>	0.66			
<i>Feeling you have a high level of job security</i>	0.54			
<i>Feeling you have adequate facilities to do a good job</i>	0.65			
<i>Having a good financial income</i>	0.45			
<i>Deriving intellectual stimulation from research</i>		0.60		
<i>Having opportunities for personal development (developing clinical/research/management skills)</i>		0.56		
<i>Being involved in activities that contribute to the development of your profession</i>		0.60		
<i>Deriving intellectual stimulation from teaching</i>		0.43		
<i>Being able to bring about positive change in your unit/institution</i>		0.35		
<i>Having a high level of responsibility</i>			0.36	
<i>Being perceived to do the job well by your colleagues</i>			0.59	
<i>Having good relationships with other staff members</i>			0.54	
<i>Having variety in your job</i>			0.41	
<i>Feeling your clinical experience is used to the full in the job you do</i>			0.40	
<i>Having good relationships with patients</i>				0.55
<i>Feeling you deal well with relatives</i>				0.79

NB: The numbers presented in this table are *factor loadings*, they express the relationship of each item to the underlying factor and can be interpreted like standard regression coefficients. HCJSSQ: Hospital Consultants' Job Stress and Satisfaction Questionnaire. Factor 1: having financial and job related certainties; Factor 2: being stimulated intellectually and developing professionally; Factor 3: being appreciated and contributing; Factor 4: having good relationships with patients and their families.

Supplement 3. Factor loadings specific anaesthesia-related stress

Anaesthesia-specific stress items	Factors		
	1.Specific demands	2.Lack of support	3.Organization
<i>Risk to patients</i>	0.53		
<i>Extremely ill patients</i>	0.71		
<i>Unexpected, difficult situations</i>	0.77		
<i>Not to know what to expect on call</i>	0.63		
<i>Acute nature of anaesthesia</i>	0.83		
<i>Time pressure (day surgery)</i>	0.54		
<i>Need to act quickly</i>	0.84		
<i>Counselling relatives</i>	0.30		
<i>Level of concentration required</i>	0.65		
<i>Level of responsibility</i>	0.76		
<i>Lack of appreciation by others</i>		0.52	
<i>Relationship with surgeons</i>		0.72	
<i>Being in a service specialty</i>		0.65	
<i>Lack of communication</i>		0.45	
<i>Isolation from other anaesthesiologists</i>		0.45	
<i>Dealing with other specialties</i>		0.76	
<i>Lack of available resources</i>			0.52
<i>Conflict between patients' wishes and professional standards</i>			0.66
<i>Lack of control over work pattern</i>			0.51
<i>Recent changes in training</i>			0.35
<i>Legal side of anaesthesia</i>			0.47

NB: The numbers presented in this table are *factor loadings*, they express the relationship of each item to the underlying factor and can be interpreted like standard regression coefficients. Factor 1: specific demands of the job; Factor 2: lack of support and appreciation; Factor 3: having to deal with organizational hassle.

CHAPTER

OCCUPATIONAL STRESS,
BURNOUT AND PERSONALITY IN
ANAESTHESIOLOGISTS;
A narrative review

R.A.B. van der Wal, J. Wallage, M.J. Bucx. Occupational stress, burnout and personality in anesthesiologists. *Current Opinion in Anesthesiology* 2018; 31(3), 351-356.

ABSTRACT

Purpose of review: There is a growing awareness of the problem of occupational stress and burnout among anaesthesiologists. Occupational stress was found to be related to burnout, a process that is supposed to be moderated by personality. This paper will discuss the topic of stress and burnout in relationship to anaesthesiologists personality based on recent literature.

Recent findings: Studies among anaesthesiologists are in concordance with the broader body of literature on this topic. Personality consistently influences stress appraisal and coping and consequently the development of burnout. Neuroticism, negative affectivity and cooperativeness all contribute to burnout.

Summary: Strategies to alleviate stress and hence the development of burnout should be directed at adapting occupational or organizational factors but also at equipping anaesthesiologists with psychological tools to deal with occupational stress. Furthermore, personality traits that predispose for development of burnout could be taken into consideration in resident selection procedures.

INTRODUCTION

Since the late 1990's about 150 papers addressing stress or burnout concerning anaesthesia have been published in the literature. The last few years however the interest and awareness of the problem of occupational stress and burnout in anaesthesiologists is gaining momentum. The annual number of new publications is increasing and the topic is also being addressed at our scientific conferences. The 2016 ASA meeting, for example, included 27 presentations related to physician well-being. This interest is not only limited to the scientific anaesthesiology community, but also occurs in lay media. For instance, the French documentary 'Burning out, dans le ventre de l'hôpital', is very illustrative of stress and burnout from the perspective of anaesthesiologists.(1)

The question arises why the problem of occupational stress and burnout is increasingly acknowledged. On the one hand, it is possible that our working conditions have changed: patients are increasingly complex and new technologies and anaesthetic techniques are rapidly introduced.(2) On the other hand it is possible that although working conditions may have changed, also workspace culture has changed. Discussing experience of occupational stress and related mental health problems such as burnout may be becoming less of a taboo than it used to be, and it should. Either way, this increased awareness is justified: the prevalence of stress and burnout among anaesthesiologists is significant, and the consequences may be serious.(3) Stress and burnout may lead to dysfunction and even drop out of anaesthesiologists, resulting in a reduction in quality of care, an increase in healthcare costs and increased pressure on the colleagues in the anaesthesia departments.

THE DIFFERENCE BETWEEN A STRESSOR AND STRESS

The term 'stress' is sometimes confused with 'stressor'. Stressors are mental, emotional or physical stimuli which trigger stress. Stress is the nonspecific adaptive response of the body to any change, demand, pressure, challenge, threat or trauma, with physical, psychological and intellectual consequences.(4) In anaesthesiology, there are specific stressors: it is a high-stakes, high-demands environment in which one has to perform under critical conditions. Examples of important anaesthesiology-specific stressors are high-ASA-grade patients, complex surgical interventions, difficult intubations, working off-site, problematic relationships with surgeons and other team members, poor working conditions, irregular working hours, high continuous education requirements, lack of time to stay organized and difficulties in the organization.(5, 6) The most important stressors reported by anaesthesiology

residents are studying for exams, concern about future job prospects and critical clinical incidents.(7)

The experience of stress happens with the perception of a threat and the consequent physiological, psychological and emotional reactions to that threat. A 2016 cross-sectional study found that 40.1% of consultant anaesthesiologists and 52% of residents were psychologically distressed.(8) A study to compare occupational stress in 435 German residents concluded that surgery residents experienced the highest levels of occupational distress, higher than residents of internal medicine, obstetrics, gynecology, pediatrics, neurology and anaesthesiology. Interestingly, the 70 anaesthesiology residents had the highest scores on depressive symptoms.(9) Another recent study of 427 anaesthesiology residents found that 28% scored high on a physiological distress scale and that 11% were currently under treatment for anxiety or depression.(7)

STRESS AND BURNOUT

Although some stress may help people perform at a higher baseline state, it has been shown that too much stress can impair both technical and non-technical skills in anaesthesiology.(10-12) Besides, enduring work-related stress can lead to negative psychological consequences such as burnout. Burnout has been defined as a syndrome of emotional exhaustion, depersonalization and feelings of diminished personal accomplishment. Emotional exhaustion refers to the draining of emotional resources. This can lead to depersonalization, a negative and cynical attitude to the recipients of one's care. Finally, feelings of diminished personal accomplishment develop, which is the tendency to evaluate one's work negatively. (13) Prevalence of burnout in anaesthesiology has recently been reported to range from 18% to 48.7% in different countries.(3) Some literature even suggests that burnout may be more prevalent in anaesthesiologists than in other physicians.(2) Burnout is a threat to the mental and physical health of the anaesthesiologist and could lead to recreational drug use, alcohol abuse and suicide.(14) Faster physiological aging is also reported in anaesthesiologists.(15) Importantly, physician burnout decreases efficiency and is a threat to patient safety. For example, physicians who have high levels of burnout report more medication errors than their colleagues without burnout.(16)

THE ROLE OF PERSONALITY IN STRESS AND BURNOUT

Most research into occupational stress and burnout focuses on the environmental correlates: the stressors.(3) These are, ultimately, the cause of occupational stress

and burnout. However, personality plays an important role as well.(17) An informative description of personality is that of Larsen and Buss: ‘Personality is the set of psychological traits and mechanisms within the individual that are organized and relatively enduring, and that influence his or her interactions with, and adaptations to, the intrapsychic, physical and social environments’.(18)

The interactions between personality, stress and burnout are schematically represented in figure 1.

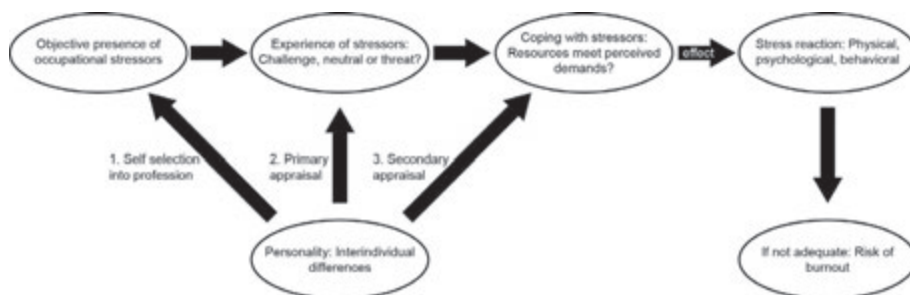


Figure 1. Interactions between personality, stressors, stress and burnout

First, personality influences which stressors people may seek out. Some people will self-select into professions, like anaesthesiology, that will likely confront them with stressful situations. It has been postulated that certain personalities will be attracted to certain specialties.(19) Indeed, differences in personality have been found between five medical specialties, among which anaesthesiology.(20)

Second, personality is expected to influence how people experience stress. The transactional model of stress, developed by Lazarus & Folkman in 1984, emphasizes the active psychological interaction between the stressor and the individual. During the primary appraisal, based on perceived demands, an individual identifies whether the stressor is a threat, a neutral or a positive challenge. A cross-sectional survey in a large sample of anaesthesiologists found a statistically significant correlation between personality and the way work-related stressors are appraised. Individuals with the tendency of experiencing negative emotions and having low social engagement appraised work related stress as more important than individuals without that tendency.(21)

Third, personality may influence the coping strategies applied to manage stress. According to the transactional model of stress, during the secondary appraisal the individual chooses whether his resources are adequate to cope with the perceived demands. Literature suggests a relationship between personality traits and coping strategies that moderate the development of stress into burnout.(22)

When individuals have personality traits that make them resilient and equipped with adequate resources to address work-related demands, they are unlikely to manifest symptoms of burnout.(23) This is illustrated by the fact that not all anaesthesiologists from the same workplace develop symptoms of stress and burnout. There has been a growing interest in investigating personality in relation to mental health problems such as burnout. A recent study among veterinarians, for example, found personality to be a better predictor for occupational stress than environmental stressors.(24)

The interest in the personalities of anaesthesiologists with respect to the demands of the job is scarce but not new.(25, 26) The relationship between burnout and anaesthesiologists' personality has already been suggested in 1997, but has not yet been extensively explored.(27) A renewed interest in anaesthesiologist personality seems justified in the light of the rising awareness of the problem of burnout.

MEASURING PERSONALITY

A recent opinion article asks whether we are selecting, training and supporting the best personalities in anaesthesiology.(28) But what personalities should we be looking for? To answer this question, we first have to look into how personality is measured. Self-reporting inventories and diagnostic interviews are used for that. Inventories measure personality in traits, personality traits are considered to be relatively stable over time. Diagnostic interviews are used to assess personality disorders.

There are several validated modern personality inventories in use. Most of these distinguish five traits, some more and others less. The differences between the inventories boil down to a matter of definition: two traits in the one inventory can be taken together in the other, or what is considered a single trait in one inventory can be subdivided in more by another instrument. An in-depth discussion of the correlations between the traits of the different inventories is beyond the scope of this review.(29)

Big Five personality inventory

At present, the most established model to generally describe personality is the so called big five theory. The big five personality inventory (BFI) assesses five traits: neuroticism, extraversion, openness to experience, conscientiousness and agreeableness. Research using factor analysis has shown that personality can be comprehensively described in these five traits.(30)The five traits are bipolar and

cover a high-to-low continuum. Neuroticism, as opposed to emotional stability, is associated with terms such as nervousness, anxiety, moodiness and hostility. Extraversion, as opposed to introversion, is associated with terms such as playfulness, spontaneity, assertiveness and dominance. Openness to experience, as opposed to conventional or conservative, is associated with terms such as originality, creativity, non-religiousness, independence, and having broad interests. Conscientiousness concerns a person's attitude to work and achievement. The last trait is agreeableness, as opposed to hostility, also known as altruism and associated with qualities such as love, empathy, friendliness and cooperation.(30)

Already in 1998, a comprehensive review of 250 studies on burnout and personality reported that neuroticism was strongly correlated with burnout.(31) More recent studies show the same: in a longitudinal study from 2012 that controlled for time, age, gender, work hours and depression, it was found that neuroticism positively predicted burnout. Conscientiousness negatively predicted burnout.(32) A study in healthcare workers from 2015 also found emotional stability (the opposite of neuroticism) to be negatively related to burnout.(33) A cross-sectional study among anaesthesiologists, published in 2016, found neuroticism to be an important risk factor for burnout, while extroversion and agreeableness seemed to work protectively.(8)

The relationship between neuroticism and burnout is expected, because neuroticism is characterized by fearfulness, low self-esteem, social anxiety, poor inhibition of impulses, helplessness and irritability. It may seem obvious to state that it is a desirable trait for an anaesthesiologist to be emotional stable, but it is also shown to be the case: the body of literature seems conclusive about the relation between burnout and neuroticism, for anaesthesiologists and others.

Temperament and Character Inventory

Another instrument to describe personality is the Temperament and Character Inventory (TCI). The TCI evaluates personality under the assumption that personality structure is composed of temperament and character.(34) Temperament includes four traits (novelty seeking, harm avoidance, reward dependence and persistence) which are influenced by genetic predisposition and contribute to behavioral decisions. Character includes three traits (self-directedness, cooperativeness and self-transcendence) which mature in adulthood and influence personal and social effectiveness. This personality inventory has previously been used to describe personality in anaesthesiologist in comparison to other physicians and the general

population.(26) A recent study in Japanese residents found that the TCI could predict the risk for future burnout because residents with high cooperativeness were significantly more prone to burnout. The more selfless the resident, the greater the likelihood of burnout.(35)

Other personality constructs and burnout

Type D personality is characterized by feelings of psychological stress and high levels of negative affectivity and social inhibition. This corresponds roughly to the Big Five personality traits of neuroticism and introversion. High negative affectivity is described as having negative feelings such as dysphoria, anxiety and tension. The social inhibition is explained as failure of revealing feelings due to fear of disapproval. A 2016 study among Turkish healthcare professionals found that Type D personality was strongly related to burnout.(36) The Type D personality is known as a distressed personality profile. An analogous personality profile was also found in an analysis of Big Five inventory results of Dutch anaesthesiologists. (21)

Recent studies outside of our specialty have looked into the concepts of emotional intelligence and empathy. Emotional intelligence has been described as awareness of one's own emotions and thoughts and the ability to use this awareness to guide further actions and thoughts. The trait is considered flexible rather than static; it can be learned and thus evolve. It has been postulated that emotional intelligence is important in managing stressful situations. In surgical residents, it was found that high EI is associated with improved job satisfaction and a predictor of well-being. (37, 38) Empathy is important for establishing interpersonal relationships and is emphasized as a necessary tool for integrating emotional and cognitive factors. It is a construct of personality and has a relationship with burnout. Studies found negative correlations between lower scores on empathy and burnout.(39, 40) However, the question is whether empathy protects against the development of burnout or that empathy decreases as a result of burnout, analogous to the depersonalization that is part of the burnout syndrome.

TOOLS TO INCREASE PERSONAL RESILIENCE

To reduce physician stress and burnout, it is important both to reduce stressors through structural or organizational interventions and to focus strategies on the individuals.(41) A personalized approach to prevent the culmination of stress into burnout might help to increase resilience by equipping individuals with tools to cope with stress. For example, some residency curricula are now implementing resident

wellness programs.(42) Mindfulness and emotional regulation strategies to manage stress and enhance self-compassion also look promising in the prevention and management of burnout.(43) However, more studies are needed to establish their importance.

Another personalized approach could be to select individuals into anaesthesiology with personalities that are protective against burnout. Individuals who evaluate stressful situations as a challenge rather than a threat are more resilient to the experience of stress and hence the development of burnout. For example a recent publication discusses stress appraisal measurements that could potentially be used to assess applicants for anesthesiology residency.(44)

4A

SUMMARY AND CONCLUSIONS

Anaesthesiology is considered one of the most stressful medical specialties. If not properly managed, this occupational stress can lead to negative psychological consequences such as burnout and consequently to a decreased quality of care. To prevent this the occupational stressors of anesthesia should be addressed and adapted if possible.

It has been well established that personality influences a person's attitude to unpredictable and difficult situations and moderates coping mechanisms. For that reason, stress, personality and their interrelationship affect anaesthesiologists' well-being, risk of burnout and clinical performance. Resiliency and emotional intelligence can be enhanced; several specific programs look promising, although their effects still need to be established. Furthermore, attention could be given to selecting people with personality traits that make them fit to handle the stressors of the job. More research is needed to identify personality traits that are helpful in predicting appraisal of and resiliency to the occupational stress of anaesthesiologists, thereby enhancing performance and reducing the risk of burnout. These traits or subsets of traits may be found in the Big Five personality inventory or other general personality measures. In addition, personality constructs such as emotional intelligence and empathy may potentially be helpful in addressing the problem of occupational stress and burnout.

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CHAPTER

PSYCHOLOGICAL DISTRESS, BURNOUT AND PERSONALITY TRAITS IN DUTCH ANAESTHESIOLOGISTS: A SURVEY

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STRUCTURED ABSTRACT

Background: The practice of anaesthesia comes with stress. If the demands of a stressful job exceed the resources of an individual, that person may develop burnout. Burnout poses a threat to the mental and physical health of the anaesthesiologist and therefore also to patient safety.

Objectives: Individual differences in stress appraisal (perceived demands) are an important factor in the risk of developing burnout. To explore this possible relation, we assessed the prevalence of psychological distress and burnout in the Dutch anaesthesiologist population, and investigated the influence of personality traits.

Design: Survey study

Setting: Data was collected in the Netherlands from July 2012 until December 2012.

Participants: We sent electronic surveys to all 1955 practicing resident and consultant members of the Dutch Anaesthesia Society (NVA). Of those, 655 (33.5%) were returned and could be used for analysis.

Main outcome measures: Psychological distress, burnout and general personality traits were assessed using validated Dutch versions of the General Health Questionnaire (GHQ-12, cut-off point ≥ 2), the Maslach Burnout Inventory (UBOS-C) and the Big Five Inventory (BFI). Sociodemographic variables and personality traits were entered in regression models as predictors for burnout and psychological distress.

Results: Psychological distress and burnout were prevalent in 39.4% and 18% of respondents, respectively. The prevalence of burnout was significantly different in resident and consultant anaesthesiologists, 11.3% vs. 19.8% ($\chi^2 = 5.4$; $p < 0.02$). The most important personality trait influencing psychological distress and burnout was neuroticism ($OR_{adj} : 6.22$ (95% CI: 4.35;8.90) and $OR_{adj} : 6.40$ (95%CI: 3.98;10.3) respectively).

Conclusions: The results of this study show that psychological distress and burnout have a high prevalence in residents and consultant anaesthesiologists and that they both are strongly related to personality traits, especially the trait of neuroticism. This suggests that strategies to address the problem of burnout would do well to focus at competence in coping skills and staying resilient. Personality traits could be taken into consideration during the selection of residents. In future longitudinal studies, the question should be addressed how personal and situational factors interact in the development of burnout.

INTRODUCTION

Anaesthesiologists deal with extreme working hours, high-risk patients and situations, and an increasingly complex working environment.[1-6] Although the practice of anaesthesia can be very stressful, this does not necessarily mean that an anaesthesiologist experiences psychological or physiological symptoms of stress.[7, 8] However, it is known from psychological research that stress reactions do occur when demands exceed resources. Stress reactions manifest as behavioural changes, but also as physical or psychological illness, such as burnout.[9] Burnout poses a threat to the mental and physical health of the anaesthesiologist and therefore also to patient safety. Burnout has been defined as a syndrome with dimensions of emotional exhaustion, depersonalization and feelings of reduced personal accomplishment.[10] In psychiatry, the term depersonalization is used to describe an anomaly in self-awareness. In the context of burnout, however, depersonalization refers to an increased emotional distance between workers and their clients or patients. This attitude may be the result of emotional exhaustion and may lead to feelings of reduced personal accomplishment.[11]

The transactional model of stress, developed by Lazarus & Folkman, emphasizes the active psychological interaction between the stressor and the individual. During the primary appraisal, an individual identifies based on perceived demands whether the stressor is a threat or a neutral or a positive challenge. In the secondary appraisal, the individual then chooses how to use his resources to cope.[12] Threat appraisal and coping mechanisms may differ widely between individuals. When individuals have personality traits that make them resilient and equipped with adequate resources to address work-related demands, they are unlikely to manifest symptoms of burnout. [13] Literature suggests a relation between personality traits and coping strategies that moderate the development of stress into burnout.[14] Therefore personality traits are an important element in the process of developing burnout.[15, 16]

At this moment, the Big Five model of personality traits is the most established and validated system used in literature.[17] The Big Five traits to describe personality are neuroticism, extraversion, openness to experience, conscientiousness, and agreeableness. These personality traits are considered to be relatively stable in an individual over time and across situations.[18]

Until now, the relationship between personality traits, stress and burnout has never been studied in anaesthesiologists. The only studies on personality traits in anaesthesiologists used tests which are now considered obsolete. [19-21] For that reason the role of the Big Five personality traits in anaesthesiologists psychological distress and burnout is unknown.

The objectives of this study are to examine the prevalence of psychological distress and burnout in Dutch anaesthesiologists and to explore the relationship between psychological distress, burnout and personality traits.

METHODS

This survey study was approved on April 2th 2012 by the local ethical committee (Commissie Mensgebonden Onderzoek regio Arnhem-Nijmegen, The Netherlands, Chairman dr. F.Th.M. Huysmans, ethical committee nr 2012/148).

Participants

In July 2012 questionnaires were sent to all 1955 consultant and resident members of the Dutch Society of Anaesthesia (NVA) using the web-based program RadQuest. Anonymity was guaranteed. RadQuest was developed by the Department of Medical Psychology and the Department of Instrumental Services of the Radboud University Medical Centre. Non-respondents received an electronic reminder after three months. Data was collected until December 2012.

Measurements

The questionnaire consisted of 206 items, including general sociodemographic questions concerning sex, age, number of children under 18, marital status, years practicing as an anaesthesiologist, subspecialty, and whether the respondent works as a resident or a consultant, in an academic or community hospital. The questionnaire also contained several psychological instruments validated in Dutch samples.

Psychological distress

Psychological distress was assessed by the General Health Questionnaire 12 (GHQ-12).[22] The GHQ-12 consists of 12 questions referring to unpleasant and unusual mental phenomena and impairment of normal functioning. Examples of questions asked are: 'Have you been able to cope with your problems lately?' and 'Did you have difficulty sleeping because of worrying lately?'. A 4-point Likert scale was used, ranging from never to much more than usual. For each question one point was scored if one of the two least favourable options was chosen. A sum of scores of two or more was considered indicative of psychological distress, which is in line with recommendations for use in the general population.[22-25]

Burnout

Burnout was measured with the Dutch version of the Maslach Burnout Inventory: the Utrechtse Burnout Schaal (UBOS-C).[26] The UBOS-C consists of 20 items, such as: 'At the end of the day I feel empty' and 'I do not care what happens to my patients'. Each item is scored using a 7-point Likert scale, ranging from never (0) to daily (6). The average score per dimension is calculated (emotional exhaustion: 8 items, depersonalization: 5 items, personal accomplishment: 7 items). Burnout has been defined as a combination of a high score on emotional exhaustion *and* a high score on depersonalisation, a low score on personal accomplishment, or both. High or low scores in one of the dimensions have been defined as scores above the 75th percentile or below the 25th percentile. These values are extensively described in the accompanying manual of the UBOS-C. For this study, we used the table for healthcare workers.[26] The Cronbach's α of the dimensions of the UBOS-C (emotional exhaustion, depersonalisation en personal accomplishment) in our sample were 0.90, 0.70 and 0.75, respectively, confirming good internal consistency of these dimensions of the UBOS-C.

Personality traits

We used a Dutch translation of the Big Five Inventory (BFI) questionnaire, examining the five traits in 44 items on a 5-point Likert scale. The scores are averaged, so the minimum score per trait is 1 point and the maximum score is 5 points.[27] The five traits are bipolar and cover a high-to-low continuum. Extraversion (as opposed to introversion, 8 items) is associated with terms such as playfulness, spontaneity, assertiveness and dominance. Neuroticism (as opposed to emotional stability, 8 items) is associated with terms such as nervousness, anxiety, moodiness and hostility. Openness to experience (as opposed to conventional or conservative, 10 items) is associated with terms such as originality, creativity, non-religiousness, independence, and having broad interests. Conscientiousness (9 items) encompasses a variety of descriptors concerning a person's attitude to work and achievement. The last trait is agreeableness, also known as altruism (as opposed to hostility, 9 items). This trait is associated with qualities such as love, empathy, friendliness and cooperation.[18] The Cronbach's α of the dimensions of the BFI (neuroticism, extraversion, openness to experience, conscientiousness and agreeableness) in our sample were 0.83, 0.81, 0.80, 0.76 and 0.74 , respectively, confirming good internal consistency of the BFI as well.

Statistical methods

The Mann-Whitney test was used to test for differences between the function groups (consultants, residents) in case of continuous variables. The chi-square test was used in case of nominal variables and specifically the Fisher exact test in case of two by two tables.

Univariable logistic regression was used to study the differences in sociodemographic variables and the personality traits between anaesthesiologists with and without burnout or psychological distress as measured with the GHQ-12, separately. To this purpose, categories of a specific variable were grouped in case of small numbers. The (crude) odds ratios (OR) with 95% confidence intervals (CI) are presented.

Multivariable logistic regression with forward selection procedures was used to identify the variables that contributed independently to the risk of burnout and psychological distress as measured with the GHQ-12, respectively. Reference values were chosen arbitrarily; this statistical method compares groups (within the variable) with each other and it does not matter which group is chosen as the reference group. Because forward selection procedures do not identify other important variables, probability values for entry into the model were considered to find close alternatives to the variables selected. All sociodemographic variables and all personality trait variables were valid for selection. The adjusted OR-s with 95% CI of the final burnout-model and of the final psychological distress-model are presented. The adjusted R-square is presented to indicate the total percentage explained variance in the outcome and the area under the of the receiver operating characteristic curve (AUC) is presented as a measure of predictive discrimination.

In this study we also aimed to identify the demographic variables and the personality trait variables that are related to each of the three dimensions of burnout, separately.

Univariable linear regression was used to study the influence of the demographic variables and the personality trait variables on each of the three dimensions of burnout, separately. The dependent variable was the specific dimension of burnout. The (crude) regression coefficients with the 95% CI are presented.

Analogous to the methods described above, multivariable linear regression with forward selection procedures was used to identify the variables that independently influence a specific dimension of burnout. Reference values were chosen arbitrarily. The adjusted regression coefficients with the 95% CI of the final models are presented. The R-square is presented to indicate the total percentage explained variance. Again, close alternatives to the final models are considered.

A p-value of <0.05 was considered statistically significant. Statistical analyses were performed using SAS 9.2 for Windows (SAS Institute Inc., Cary, NC, USA) and SPSS Statistics for Windows (Version 20.0, IBM Corp., Armonk, NY, USA).

RESULTS

A total of 1955 anaesthesiologists were asked to participate; 655 (33.5%) questionnaires were returned and could be used for analysis. Response rates of consultants and of residents were in the same range (35% and 27% respectively). Consultant anaesthesiologists returned 514 questionnaires and resident anaesthesiologists returned 141 questionnaires. Sociodemographic details are presented in table 1. The male-female ratio was 388 (59.2%), 267 (40.8%) respectively. Most of the respondents 577 (86.6%) were in a relationship, 63 (9.6%) were single and 25 (3.8%) were divorced or widowed. Approximately half of the respondents had children younger than 18 years of age, 345 (54%). The mean age of the respondents was 43.7 (26-64) years.

Table 1. Sociodemographic variables of consultant and resident anaesthesiologists

	Total (n=655)		Consultants (n=514)		Residents (n=141)	
Gender						
Male	388	(59.2%)	335	(65.2%)	53	(37.6%)
Female	267	(40.8%)	179	(34.8%)	88	(62.4%)
Age (year)	43.7	(26-64)	47.2	(30-67)	31	(26-48)
Relationship						
Single	63	(9.6%)	34	(6.6%)	29	(20.6%)
Married*	567	(86.6%)	455	(88.5)	112	(79.4%)
Divorced*	25	(3.8%)	25	(4.9%)	0	(00.0%)
Children***						
Yes	354	(54%)	317	(61.7%)	37	(26.2%)
No	301	(46%)	197	(38.3%)	104	(73.8%)
Hospital						
Academic centre	295	(45%)	343	(66.7%)	171	(33.3%)
Community hospital	360	(55%)	17	(12.1%)	124	(87.9%)

Data are numbers (and percentages) or medians (and ranges).

*Including living together; **including widowed (n=2); *** children beneath the age of 18 Comparing the respondents with the non-respondents for sex-ratio, consultant-resident-ratio, and the percentage working in an academic centre or community hospital, showed that these ratios were close, indicating that as far as these variables are concerned we have a representative sample.

Table 2 summarizes psychological distress, burnout and personality traits in consultants and residents. Of all respondents, 39.4% indicated experiencing psychological distress; 40.1% of the consultants and 36.9% of the residents. No significant differences were found between consultants and residents nor were differences found between anaesthesiologists working in academic centres and those working in community hospitals.

In total, 18% of respondents met the predefined criteria for burnout. The respective values for consultants and residents were 19.8% and 11.3%. This difference was significantly different ($\chi^2 = 5.4$; $p < 0.02$). No significant differences were found between men and women, whether consultant or resident, nor between anaesthesiologists working in an academic centre or in a community hospital. The small differences in personality traits between consultants and residents did not reach statistical significance.

Table 2. Psychological distress, burnout and personality traits in consultant and resident anaesthesiologists

	Total (n=655)			Consultants (n=514)			Residents (n=141)		
	n	(%)	mean (SD)	n	(%)	mean (SD)	n	(%)	mean (SD)
Psychological distress (yes) (GHQ-12)	258	(39.4%)		206	40.1%		52	(36.9%)	
Burnout (UBOS-C) (yes)	118	(18.0%)		102	19.8%		16	(11.3%)	
Emotional exhaustion (0-6)			1.53 (0.99)			1.57 (1.04)			1.39 (0.75)
Depersonalisation (0-6)			1.14 (0.75)			1.16 (0.77)			1.12 (0.65)
Personal accomplishment (0-6)			4.2 (0.69)			4.2 (0.71)			4.17 (0.64)
Personality traits (Big Five)									
Neuroticism (1-5)			2.36 (0.60)			2.37 (0.62)			2.34 (0.54)
Extraversion (1-5)			3.43 (0.60)			3.40 (0.60)			3.54 (0.56)
Openness to experience (1-5)			3.54 (0.54)			3.55 (0.54)			3.48 (0.52)
Agreeableness (1-5)			3.75 (0.47)			3.73 (0.47)			3.83 (0.45)
Conscientiousness (1-5)			3.89 (0.47)			3.90 (0.48)			3.86 (0.42)

GHQ-12: general health questionnaire with cut off point ≥ 2 ; SD: standard deviation

Table 3 shows the crude and the adjusted odds ratios with 95%CI of the sociodemographic variables and the personality traits influencing psychological distress and burnout. Please note that in a univariable (crude) analysis variables are analysed in isolation and that the reference values chosen are arbitrarily (divorced, having no children and being a resident). In a multivariable analysis all variables are analysed together.

The personality trait neuroticism is the most important factor positively influencing the presence of psychological distress, so neuroticism is a risk factor. Other relevant, but less important, factors are having children and the personality trait openness. Multivariable logistic regression with selection procedure was used. The adjusted R^2 of the multivariable model was 0.27, indicating that 27% of the observed variability could be explained by this model. The area under the ROC-curve was 0.76, indicating a good discriminatory power of the final model.

Neuroticism again is the most important factor positively influencing the presence of burnout, so neuroticism is a risk factor. Protective personality traits are extraversion and agreeableness. Sociodemographic variables did not have an effect. Multivariable logistic regression with selection procedure was used. The adjusted R^2 of the multivariable model was 0.34, indicating that 34% of the observed variability could be explained by this model. The area under the ROC-curve was 0.83, indicating a good discriminatory power of the final model.

Table 3. Sociodemographic variables and personality traits influencing psychological distress and burnout

	Psychological distress (GHQ-12)				Burnout (UBOS-C)			
	univariable analysis		multivariable analysis		univariable analysis		multivariable analysis	
	OR _{crude}	(95%CI)	OR _{adj}	(95%CI)	OR _{crude}	(95%CI)	OR _{adj}	(95%CI)
Sociodemographics								
Gender			-				-	
Male	0.71	(0.52;0.98)			0.88	(0.59;1.32)		
Female	1.00	(reference)			1.00	(reference)		
Age (years)	0.98	(0.97;1.00)	-		0.99	(0.98;1.02)	-	
Relationship							-	
Single	1.05	(0.41;2.65)	0.92	(0.32;2.69)	2.93	(0.78;11.0)		
Married*	0.66	(0.30;1.48)	0.47	(0.19;1.18)	1.51	(0.44;5.16)		
Divorced**	1.00	(reference)	1.00	(reference)	1.00	(reference)		
Children***							-	
Yes	1.46	(1.06;2.00)	1.82	(1.24;2.66)	1.19	(0.80;1.78)		
No	1.00	(reference)	1.00	(reference)	1.00	(reference)		
Function							-	
Consultant	1.14	(0.78;1.68)	-		1.93	(1.10;3.40)		
Resident	1.00	(reference)			1.00	(reference)		
Personality traits								
Neuroticism	5.56	(3.96;7.80)	6.22	(4.35;8.90)	8.77	(5.67;13.6)	6.40	(3.98;10.3)
Extraversion	0.49	(0.34;0.59)	-		0.27	(0.18;0.39)	0.44	(0.28;0.69)
Openness	0.99	(0.74;1.32)	1.58	(1.12;2.23)	0.89	(0.61;1.29)	1.77	(1.10;2.83)
Agreeableness	0.58	(0.41;0.82)	-		0.25	(0.16;0.40)	0.52	(0.30;0.89)
Conscientiousness	0.67	(0.48;0.93)	-		0.37	(0.24;0.57)	-	

Univariable logistic regression and multivariable logistic regression with selection procedure was used; OR, odds ratio; crude, univariable model; adj, adjusted for all other variables in the model; CI, confidence interval; -, not selected; GHQ-12, General Health Questionnaire with cut off point ≥ 2 . *including living together; **including widowed (n=2); ***children younger than 18 years of age. Please note that in the univariable analysis variables are taken in consideration in isolation, the reference values chosen are arbitrarily (divorced, having no children and being a resident). Whereas in the multivariable analysis all variables together are taken in consideration. The adjusted R^2 of the final model of GHQ-12 and of burnout was 27% and 34% respectively.

Table 4 presents the crude and the adjusted regression coefficients with 95%CI of the demographic variables and the personality traits influencing the three dimensions of burnout. Emotional exhaustion is independently related to neuroticism, extraversion and openness. Sociodemographic variables had no effect. All five personality traits and also three sociodemographic variables (gender, age and being a consultant) were independently related to depersonalization. Personal accomplishment is related to all five personality traits and one sociodemographic variable (having a relationship). Of the five personality traits, neuroticism is the most important risk factor for the three dimensions of burnout. Logistic regression with selection procedure was used. The observed variability (R^2) explained by these three multivariable models was 36%, 28% and 31%, respectively.

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Table 4. Sociodemographic variables and the personality traits influencing the three dimensions of burnout

	Emotional exhaustion			Depersonalization			Personal accomplishment		
	univariable analysis	multivariable analysis	β_{adj} (95%CI)	univariable analysis	multivariable analysis	β_{adj} (95%CI)	univariable analysis	multivariable analysis	β_{adj} (95%CI)
Sociodemographics									
Gender	-	-	-	-	-	-	-	-	-
Male	-0.17 (-0.32; -0.01)			0.15 (0.04;0.27)	0.19 (0.08;0.30)	0.01 (-0.095;0.12)			
Female	0.00 (reference)			0.00 (reference)	0.00 (reference)	0.00 (reference)			
Age (years)	0.00 (0.00;0.00)	-	-	-0.01 (-0.02;0.00)	-	0.00 (0.00;0.01)	-	-	-
Relationship	-	-	-	-	-	-	-	-	-
Single	-0.46 (-0.78;-0.14)			0.01 (-0.25;0.45)		0.30 (-0.15;0.76)	-0.35 (-0.62; -0.08)		
Married*	-0.28 (-0.56; -0.01)			-0.02 (-0.31;0.28)		0.04 (-0.35;0.43)	-0.18 (-0.41; 0.05)		
Divorced**	0.00 (reference)			0.00 (reference)		0.00 (reference)	0.00 (reference)		
Children***	-	-	-	-	-	-	-	-	-
Yes	0.14 (-0.01;0.29)			0.31 (0.00;0.23)		0.02 (-0.09;0.13)			
No	0.00 (reference)			0.00 (reference)		0.00 (reference)			
Function	-	-	-	-	-	-	-	-	-
Consultant	0.19 (1.22;1.55)			0.04 (-0.01;0.17)	-0.17 (-0.32; -0.00)	0.04 (-0.091;0.16)			
Resident	0.00 (reference)			0.00 (reference)	0.00 (reference)	0.00 (reference)			
Personality traits									
Neuroticism	0.95 (0.84;1.05)	0.89 (0.78;1.00)	0.53 (0.45;0.62)	0.37 (0.26;0.47)	-0.53 (-0.61; -0.45)	-0.31 (-0.40; -0.22)			
Extraversion	-0.55 (-0.677; -0.43)	-0.21 (-0.32; -0.94)	-0.40 (-0.50; -0.32)	-0.20 (-0.29; -0.10)	0.36 (0.28;0.45)	0.10 (0.01;0.18)			
Openness	-0.08 (-0.23;0.05)	0.17 (0.05;0.29)	-0.07 (-0.18;0.03)	0.14 (0.04;0.23)	0.30 (0.21;0.40)	0.12 (0.03;0.21)			
Agreeableness	-0.43 (-0.60; -0.28)		-0.48 (-0.60; -0.36)	-0.18 (-0.30; -0.06)	0.54 (0.44;0.65)	0.28 (0.18;0.39)			
Conscientiousness	-0.26 (-0.42; -0.09)		-0.47 (-0.59; -0.35)	-0.21 (-0.32; -0.01)	0.52 (0.41;0.63)	0.26 (0.16;0.37)			

Univariable linear regression and multivariable linear regression with selection procedure was used; β , regression coefficient ie change per unit increase or compared to the reference, respectively; crude, univariable model; adj, adjusted for all other variables in the model; CI, confidence interval; -, not selected. *including living together; ** including widowed (n=2); *** children younger than 18 years of age. Please note that in the univariable analysis variables are taken in consideration in isolation, the reference values chosen are arbitrarily (divorced, having no children and being a resident). Whereas in the multivariable analysis all variables together are taken in consideration. The adjusted R² of the final model of emotional exhaustion, depersonalization and personal accomplishment were 36%, 28% and 31%, respectively.

DISCUSSION

The problem of psychological distress and burnout has been acknowledged in our literature for over 15 years and the present study proves that the problem still needs attention. To our knowledge this is the first study relating both psychological distress and burnout to personality traits in anaesthesiologists.

Our results indicate that there is a high prevalence of psychological distress in our sample of Dutch consultant and resident anaesthesiologists (39.4%). This means that a significant proportion experiences unpleasant and unusual mental phenomena and impairment of normal functioning. This percentage is approximately double that of the general population (22.8%) but compares with the percentage in first line health care workers in the Netherlands.[24]

The prevalence of burnout in the total study group was 18%, which is on the low side of the 20-40% burnout in anaesthesiologists as reported in previous European publications.[1, 2, 5, 28-30]

When interpreting this result, it is important to realise that the prevalence of burnout in the general Dutch population is 13%. This is amongst the lowest of Europe according to a Dutch report from 2013 which compared Dutch general occupational burnout to European figures.[31] Another interesting aspect of these studies is that they reported an increased prevalence of burnout in residents.[28, 32-35] This is in contrast to the result of the present study, in which burnout was less prevalent in residents (11.3%) than in consultants (19.8%).

From a study performed by a Dutch insurance company among Dutch general practitioners it is known that not all doctors with burnout symptoms seek help or stop working.[36] If these findings are also applicable to the Dutch anaesthesiologist population it may very well be the case that colleagues experiencing symptoms of burnout keep on working and potentially pose a threat to their own mental and physical health as well as to patient safety.

When all variables (sociodemographic and personality) are taken into consideration, our multivariable analysis showed neuroticism to be the most important factor increasing the risk for presence of psychological distress (OR: 6.22) and presence of burnout (OR: 6.40). Extraversion was the most important protective factor for burnout (OR: 0.44). Being a resident or a consultant did not improve the final model.

This compares with studies in the general population. People who score high on neuroticism tend to have an increased susceptibility to their environment, a tendency to be anxious and insecure, and a high performance drive. This predisposes

them towards developing burnout. People who score high on extraversion tend to seek interactions with other people, and this may help counteract the process of depersonalization. They also tend to appraise problems in a positive way, which reduces stress and therefore risk of burnout.

Individuals with certain personality types may choose for high-stress occupations, so doctors who choose to pursue a career in anaesthesia might have personality traits that make them fit for the specific stressful demands of the job and hence reduce the chance of developing burnout. On the other hand, stress will be experienced more intensely by individuals with certain personality traits and hence will predispose them for developing burnout. Some studies indeed suggest that certain personalities tend to choose certain medical specialties. [37, 38] Anaesthesiologists have for example been reported as more intelligent, self-sufficient, dominant, tense, and introverted compared to general practitioners.[39]

Personality traits are important in burnout and psychological distress, and they are considered to be stable in time and hard to change. Therefore, strategies to address these problems can be focused on reinforcing the coping strategies of the individual. Educational programmes should be directed at personal competence and staying resilient besides professional knowledge and skills. It has for example been suggested to teach trainee anaesthesiologists certain beneficial coping styles.[6] Also personality testing may be used in selection of residents to reduce burnout in future anaesthesiologists. Furthermore it is recommended to educate colleagues about recognizing symptoms indicating burnout, such as a detached and cynical attitude towards patients and co-workers.

A reason of concern in our study could be the response rate of 33.5%. Similar studies report response rates of 26.7%-76%. In these studies response rates were inversely related to the number of participants addressed.[3, 8, 32, 35, 40-42]. Our response rate of 33.5% compares with the mean response rate of 34.6% found in a meta-analysis of 56 internet based surveys.[43] The authors of this meta-analysis also emphasize that the representativeness of a sample is much more important than the response rate obtained. Our data proved to be representative for sociodemographic variables which argues in favour of the premise that no responder bias has occurred. It can be argued that anaesthesiologists who are burnout may tend not to react on professional emails nor fill out work related questionnaires. However, the reverse may also be true, burnout anaesthesiologists may be eager to share data to call attention to their situation. Even if selection bias had occurred, the high prevalence of especially psychological distress will still be very disturbing.

In future longitudinal studies, the question should be addressed how personal and situational factors interact in the complex process of the development of burnout. Considering coping strategies would be interesting in this perspective. Also the relation between burnout and sick leave, suicide rate, critical incidents and substance abuse should be further studied. This knowledge could then be used to develop specific strategies to reduce anaesthesiologist burnout.

Furthermore is future research needed aimed at defining which specific personality traits are desired for aspiring anaesthesiologists because the Big Five personality traits is an instrument assessing general personality traits.

We conclude that in anaesthesiologists personality traits are strongly related to the presence or absence of psychological distress and burnout, with neuroticism as the most important trait influencing the presence of psychological distress and burnout, making it an important risk factor.

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CHAPTER

PSYCHOLOGICAL DISTRESS, BURNOUT
AND PERSONALITY TRAITS IN DUTCH
ANAESTHESIOLOGISTS
-Reply to letter to the editor

R.A.B. van der Wal, M.J. Bucx, J.C. Hendriks, G.J. Scheffer,
J.B. Prins. Reply to: psychological distress, burnout and
personality traits in Dutch anaesthesiologists. *European
Journal of Anaesthesiology* 2017; 34(1) 42-43.

Dear Editor,

We would like to thank Lapa et al. for showing interest in our article “Psychological distress, burnout and personality traits in Dutch anaesthesiologists” and for acknowledging in their letter to the editor our efforts to raise awareness about burnout in anaesthesiologists through our work. They came forward with some interesting contributions, which we would like to address in this response.

Indeed our results show a lower prevalence of burnout in Dutch anaesthesiologists compared to other European countries. Our paper pointed out that prevalence of burnout in the general Dutch population rates amongst the lowest of Europe.[1] It would be mere speculation to discuss explanations, which could be as miscellaneous as research methodological reasons, like the questionnaires or sample selection bias, or social or organizational factors. As to the latter it would certainly be interesting to compare work related stressors and factors causing satisfaction (which are protective against burnout [2]) between countries in a multi-national study. We recently submitted a second paper that includes an analysis of the importance of work related stressors and factors causing satisfaction in the daily life of the anaesthesiologist. Job satisfaction was related to good relationships with patients and families and being appreciated by colleagues.

Lapa et al. argue that personality traits may not be written in stone, as once thought in psychological theory, and that individuals can evolve during their work life. They further state that for this reason, individuals should not be excluded on basis of personality tests indicating they may be at risk for developing burnout. Indeed it is known that for example the general personality trait of neuroticism tends to gradually diminish over life.[3] Also people experience personal growth and develop during their professional life, but the ease in which they naturally adopt stress-relieving strategies or learn psychological means to regulate stress will be dependent on the type of person they are to begin with.[4, 5] So individual susceptibility remains an important factor in the development of burnout. Of course as an instrument of selection, the ‘Big Five’ personality trait model may be too general to use in the selection of future anaesthesiologists, let alone exclude them from the training program. More refined personality constructs are needed in that respect. Identifying those constructs is a field of research which may yield results we can use, together with other instruments, to select people best suited for the inherent and unique characteristics that makes anaesthesia stressful.

We endorse the positive effects Mindfulness Based Stress Reduction programs can have on stress management and burnout development. Training in holistic self-

care activities such as the introduction of life coaches and mindfulness meditation can be most valuable. The same holds for managerial interventions such as limited caseloads and restructuring organizations to optimally support human development. [6]

In conclusion, burnout management depends, as Lapa et al. also indicate, both on organizational and on individual factors. To address the important problem of burnout in our profession we see three possible points of engagement: First, adequate selection of people who fit the demands of the job, in which personality assessment may contribute. Second, analysis of and consequent adaption of work related stressors and factors causing satisfaction. And third, teaching anaesthesiologists stress relieving, and burnout-preventing strategies.

We look forward to future publications from our colleagues in this important field of research and would be willing to participate in a multinational endeavor to identify personal and organizational risk factors which can be used in the battle against burnout.

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CHAPTER

CHRONIC STRESS INDICATED BY HAIR CORTISOL CONCENTRATION IN ANAESTHESIOLOGISTS AND ITS RELATIONSHIP TO WORK EXPERIENCE AND EMOTIONAL INTELLIGENCE: A CROSS-SECTIONAL BIOMARKER AND SURVEY STUDY

R.A.B. van der Wal, E. Bijleveld, A.E.v. Herwaarden, M.J. Bucx, J.B.Prins, & G.J. Scheffer. Chronic stress indicated by hair cortisol concentration in anaesthesiologists and its relationship to work experience and emotional intelligence: A cross-sectional biomarker and survey study. *European Journal of Anaesthesiology* 2022; 39:26–32

STRUCTURED ABSTRACT

Background: Anaesthesiology is a stressful medical specialty. The reaction to stress is constituted by behavioral, psychological and physiological components. Chronic physiological stress can have negative consequences for health.

Objectives: First, we hypothesized that chronic physiological stress is higher for both beginning and late-career consultant anaesthesiologists. Second, we hypothesized that individuals high in emotional intelligence endure lower physiological stress.

Design: Cross-sectional biomarker and survey study.

Setting: Participants were recruited during the May 2019 annual meeting of the Dutch Anaesthesia Society.

Participants: Of the 1348 colleagues that attended the meeting a total of 184 (70 male/114 female) participated in the study. Of the study participants 123 (67%) were consultant anaesthesiologists (52M/71F) and 61 (33%) were resident anaesthesiologists (18M/43F). Exclusion criteria were endocrine disorders and not having enough hair. Also experience of a recent major life event led to exclusion for analysis of our hypotheses.

Main outcome measures: Chronic physiological stress was measured by hair cortisol concentration. Emotional intelligence was assessed using a validated Dutch version of the Trait Emotional Intelligence Questionnaire. As secondary measures, psychological sources of stress were assessed using validated Dutch versions of the home-work interference (SWING) and the effort-reward imbalance (ERI) questionnaires.

Results: In support of Hypothesis 1, hair cortisol concentration was highest among beginning and late-career consultant anaesthesiologists (quadratic effect: $b=45.5$, $SE=16.1$, $t=2.8$, $p=0.006$, $R^2=0.14$). This nonlinear pattern was not mirrored by self-reported sources of psychological stress. Our results refuted Hypothesis 2, we found no evidence for a relationship between emotional intelligence and physiological stress.

Conclusions: In the early and later phases of an anaesthesiologist's career physiological chronic stress is higher than in the middle of the career. Yet, this physiological response could not be explained from known sources of psychological stress. We discuss these findings against the background of key differences between physiological stress vs. psychological stress.

INTRODUCTION

Anaesthesiology is considered a stressful medical specialty. Anaesthesiologists work long and unpredictable hours and often have to perform under time pressure in situations that are potentially life-threatening for the patient.[1, 2] When an individual is repeatedly or continuously exposed to stress that individual is assumed to be exposed to chronic stress. In stress theories, the reaction to stress is assumed to be composed of behavioral, psychological and physiological components. Initially, these reactions are adaptive in that they help the individual to cope with the stress. However when these reactions are sustained, as happens in chronic stress, they negatively affect mental and physical health.[3]

In anaesthesiologists, behavioral consequences of chronic stress are, for example, poor performance at work and a higher risk for addiction of smoking, alcohol or drugs. Psychological consequences include job dissatisfaction and symptoms of burnout and depression.[4, 5] Physiological consequences include increased amounts of catecholamines and glucocorticosteroids such as cortisol. These can cause various negative outcomes, such as higher risk for hypertension, coronary artery disease, peptic disease, atherosclerosis, and obesity.[3] Also, chronic stress increases people's susceptibility to infections.[6] This wear and tear that the body experiences because of repeated physiological responses to psychosocial stress, is known as allostatic load.[3]

Work-related stress has also in anaesthesiologists been shown to be associated with elevated levels of cortisol.[7-10] Recent methodological developments allow researchers to measure cortisol in hair, rather than in plasma, urine, or saliva.[11] Because in growing hair at any given time deposits of cortisol are proportional to circulating cortisol, hair cortisol concentration (HCC) can retrospectively be used as a biological measure of chronic stress and allostatic load.[12]

Previous research suggests that for beginning consultants in anaesthesia stress is high, mostly because of having to work unsupervised or having to work with too little professional support. The feeling to have to prove oneself may add to this stress.[13, 14] On the other hand it has been suggested that the profession is also relatively stressful at the end of the career, as older adults have more difficulty dealing with long and irregular working hours and keeping up with an ever advancing work environment.[15, 16]

Not all individuals are equally likely to suffer from stress.[17] The negative emotions that are released by stress can affect the ability to cope with the demands of the situation. Prior research suggests that emotional intelligence (EI), a personality trait, affects the way people control and manage these emotions. Thus, EI moderates the appraisal and experience of stress. Indeed several studies found that stress responses were attenuated in individuals high in EI.[18, 19]

We hypothesized firstly: Anaesthesiologists at the beginning or end of their consulting careers will experience higher levels of chronic stress, as indicated by hair cortisol concentration, than an individual in the middle of his career. The relationship between HCC and experience will therefore have a U-shape. Secondly: high level of emotional intelligence is negatively related to chronic stress as indicated by HCC. Besides testing these hypotheses, we also explored how different sources of stress vary over the career-span, potentially explaining variation in HCC. Specifically, we examined the imbalance between work related effort and work-related reward. Also, we examined the possible interference of the home-situation on the work-situation.

METHODS

Human rights protection

Written informed consent of the participants was asked and obtained. Ethical approval for this study (Ethical Committee N° 2019-5259) was provided by the local ethical committee (Commissie Mensgebonden Onderzoek regio Arnhem-Nijmegen, chairperson Prof. dr. P.N.R. Dekhuijzen) on 8 April 2019.

Study design and variables

This study has a cross-sectional design. The main predictor variables were work experience (in years) and trait emotional intelligence. The main outcome variable was the concentration of cortisol in hair, a physiological measure of chronic stress. The secondary outcome variables were effort–reward imbalance and home–work interference, which are potential psychological sources of stress. All main predictors and outcomes were treated as continuous variables.

Setting and participants

We obtained a sample of anaesthesiologists from attendees of the May 2019 annual meeting of the Dutch Anaesthesia Society. They were either asked to participate in the study, or spontaneously volunteered. Attendees were informed of the study by the society's chair at the plenary beginning of the meeting.

Exclusion criteria

1: Insufficient hair on the back of the scalp. 2: Cushing syndrome, Addison's disease or diabetes. 3: Experience of a major life event (MLE) in the last three months because the subsequent HCC is not distinguishable from HCC caused by chronic stress.[12] MLE's are for example: loss of a loved one, loss of job, a serious illness or injury, marriage or divorce or becoming a parent.

Measurement

Demographic information such as age, gender, position and type of hospital, was asked via a questionnaire. Work experience was measured (in years), either as a resident or as a consultant. The questionnaire included a brief explanation of MLE's, and included an open-ended question that asked about any MLE's in the past three months. Participants' responses were later coded according to predefined criteria.

Cortisol concentration was measured from the proximal 3 cm of a sample of hair. The samples contained 200-300 hairs and were cut from the vertex of the scalp by a professional hair artist. As hair grows approximately 1 cm per month, the proximal 3 cm's of hair correspond with the last 3 months. In a laboratory, the hair was minced, cortisol was extracted, and cortisol levels were determined by liquid chromatography-mass spectroscopy (LC/MS/MS).[20] For the exact procedure see appendix 1.

To measure emotional intelligence we used a validated Dutch version of the Trait Emotional Intelligence-Questionnaire, short form (TEI-Que SF). Trait Emotional Intelligence (TEI) captures a set of affect-related traits, which are scattered throughout the five dimensions of the Big Five model of personality.[21] The TEI-Que SF measures TEI in 4 dimensions on a 1-7 Likert-scale: Well-being (6 items), Self-control (6 items), Emotionality (8 items) and Sociability (6 items) and also provides a total score.[21, 22] Cronbach α 's in our sample were: 0.71, 0.68, 0.66, 0.65 and 0.87 respectively and therefore acceptable.

To explore known sources of work-related stress we used the short form of the Effort–Reward Imbalance (ERI) questionnaire. To assess the imbalance between effort and reward, it is commonly advised to calculate their ratio. A number close to zero indicates a favorable condition (low Effort/high Reward) and a number above one signifies an unfavorable condition (high Effort/low Reward).[23, 24] The Effort and Reward-scales (10 items, 1-4 Likert scale) of the ERI showed acceptable internal consistency with Cronbach α 's of 0.74 and 0.76 respectively. To explore possible influence stemming from the home situation on work stress, we assessed home–work interference using the SWING (Survey Work–Home Interaction NijmeGen)-questionnaire (9 Items, 0-3 Likert-scale) [25]. The scale for positive Home-Work interference (HWI) and the scale for negative HWI showed acceptable internal consistency with Cronbach α 's of 0.77 and 0.68 respectively.

Statistical procedures

To test Hypothesis 1, we carried out quadratic regression analysis, which can be used to test hypotheses that involve a U-shaped relation between two variables. Also quadratic regression does not require to discretize years of experience, which would be

associated with less statistical power and an increased chance of finding false positives. [26] Quadratic regression is different from linear regression, in that the regression equation includes not only a linear term ($b_1 * x$) but also a quadratic term ($b_2 * x^2$) for the predictor of interest. We included years of experience (linear) and years of experience (quadratic) as our predictors. Hair cortisol concentration (HCC) was the main outcome variable; we included sex (dummy coded) as a covariate.[27] As Hypothesis 1 applied to consultants, consultants and residents were analyzed separately.

To test Hypothesis 2, we carried out linear regression analysis in the full sample, with TEI as the main predictor variable. Again, HCC was the main outcome variable; we corrected for sex.

Finally, in an exploratory fashion, we examined whether effort–reward imbalance and home–work interference behave in the same way as HCC. That is, we used years of experience to predict these two secondary outcome variables.

Subjects who had missing data on HCC were excluded from analysis. The very few missing data points from the TEI, ERI and SWING questionnaires (e.g., because subjects skipped an item) were dealt with as advised by the respective user manuals. There were no missing sociodemographic data.

Statistical analysis and data visualization was done in ‘R’ version 3.6.1 2019, RStudio Inc, Vienna Austria.

Study size

Hypotheses 1: Based on 2000 simulations with the proposed statistical model: $HCC = \text{intercept} + \beta_1 * \text{experience} + \beta_2 * \text{experience}^2$, then: for $\beta_2 = .30$, 80% power is reached at $n=120$. *Hypotheses 2:* Based on 2000 simulations with the proposed statistical model: $HCC = \text{intercept} + \beta_1 * TEI$, then for $\beta_1 = .30$, 80% power is reached at $n=90$.

Bias

We pre-registered our hypotheses and analyses plan at www.aspredicted.org (registration ID = #23213) before we started data collection. All data (questionnaires and HCC values) were entered by research assistants in a certified electronic database (Castor EDC: www.castoredc.com). The database was locked after data entry and was checked by another research assistant. Subjects either randomly participated or were randomly recruited by research assistants. The link to the permanent data storage is available from the corresponding author on reasonable request. All measures in this study are reported in this paper.

RESULTS

Descriptive data of participants

Table 1 presents the sociodemographic details of our sample. Of the 1348 resident and consultant anaesthesiologists that attended the 2019 meeting, a total of 184 colleagues (70 male/114 female) agreed and was eligible to participate in the study. About 25% of residents compared to 20% of the consultants reported a MLE in the past three months. These were excluded from all analyses reported below.

Table 1. Sociodemographic variables of our sample of consultant and resident anaesthesiologists.

	Total (n=184)		Consultants (n=123)		Residents (n=61)	
Gender						
Male	70	(38%)	52	(42,3%)	18	(29.5%)
Age	38.5	(26-68)	45	(31-68)	30	(26-42)
Relationship						
Single	14	(7,6%)	7	(5.7%)	7	(11.5%)
Married/In relationship	164	(89.1%)	110	(89.4%)	54	(88.5%)
Divorced*	6	(3.3%)	6	(4.9%)		
Children**						
Yes	95	(51.6%)	76	(61.8%)	18	(29.5%)
Major Life Event***						
Yes	39	(21.2%)	24	(19.5%)	15	(24,6%)
Hospital						
Academic centre	94	(51,1%)	45	(36.6%)	49	(80.3%)
General hospital	57	(31.0%)	47	(38.2%)	10	(16.4%)
Community hospital	31	(16.8%)	29	(23.6%)	2	(3.3%)
Specialty hospital	1	(0,5%)	1	(0.8%)		
Private clinic	1	(0.5%)	1	(0.8%)		
Full time percentage***	90	(0-100)	90	(0-100)	90	(80-100)
Night shifts						
yes	140	(76.1%)	107	(87%)	33	(54.1%)

Data are numbers (and percentages) or medians (and ranges)

*Including widowed (n=1); ** Children beneath the age of 18; ***In last three months

OUTCOME DATA

Table 2 shows the mean values for hair cortisol concentrations, the Trait Emotional Intelligence Questionnaire and the Home–Work Interference and Effort–Reward Imbalance questionnaires. In six consultants, the quality of the hair sample was insufficient to measure HCC.

Table 2. Hair Cortisol Concentration, Trait Emotional Intelligence, Home-work interference and Effort-Reward Imbalance in our sample of consultant and resident anaesthesiologists.

	Total (n=184)		Consultants		Residents	
HCC* (pmol/g)	n=176***		n=116		n=60	
Total group	16.3	(15.0)	17.4	(17.4)	14.1	(8.2)
Major Life Event	19.0	(15.0)	20.9	(18.6)	16.0	(6.0)
No Major Life Event	15.6	(14.9)	16.6	(17.1)	13.5	(8.7)
Questionnaires	n=184***		n=123		n=61	
Total TEI** (1-7)	5.3	(0.58)	5.3	(0.61)	5.3	(0.53)
Subdimensions of TEI						
Wellbeing (1-7)	5.8	(0.72)	5.8	(0.75)	5.8	(0.67)
Self-Control (1-7)	5.0	(0.89)	5.1	(0.83)	4.9	(0.86)
Emotionality (1-7)	5.5	(0.67)	5.5	(0.70)	5.5	(0.62)
Sociability (1-7)	4.7	(0.83)	4.7	(0.89)	4.8	(0.70)
Home-Work interference						
Positive (0-3)	1.4	(0.64)	1.4	(0.67)	1.4	(0.60)
Negative (0-3)	0.56	(0.39)	0.50	(0.36)	0.67	(0.42)
Effort-Reward Imbalance						
Reward (1-4)	3.0	(0.53)	3.0	(0.61)	3.1	(0.35)
Effort (1-4)	3.0	(0.66)	3.1	(0.66)	2.8	(0.61)
Effort/reward ratio	1.03	(0.37)	1.1	(0.40)	0.92	(0.24)

Data are means (and SD)

*Hair Cortisol Concentration **Trait Emotional Intelligence *** The discrepancy between the number of participants in HCC measurement and questionnaires is explained in the results section.

In very experienced consultants we found a small cluster of samples with HCC above 90 pmol/g, bordering the upper limit for healthy individuals reported in literature.[28] Although these samples could be considered outliers, we chose to include them in our analysis because as one of those cases experienced an MLE it cannot be ruled out that in this category these high values of HCC are indicative of experienced stress. The subject who reported an MLE was of course excluded from analysis of our main hypotheses. One case concerned a retired anaesthesiologist and was not included in further analysis. In the resident group there was one outlier of 325 pmol/g. We suspect this may be a presentation of cortisol hyper synthesis.[28] This case was not included in further analysis.

MAIN RESULTS

Hypothesis 1: Years of experience and hair cortisol concentration

Among consultants, our analysis yielded a significant linear effect of years of experience, ($b=41.7$, $SE=16.9$, $t=2.5$, $p=0.015$) and, as predicted, a significant quadratic effect ($b=45.4$, $SE=16.1$, $t=2.8$, $p=0.006$) (Figure 1). The effect of sex was not significant ($b=-4.5$, $SE=3.5$, $t=-1.3$, $p=.198$). Together, these predictors explained 14% of the total variance in HCC. In support of Hypothesis 1, HCC was higher both at the beginning and at the end of consultant anaesthesiologists' career. Specifically, according to our statistical model, HCC was lowest after ± 11 years of work experience as a consultant. Next, we examined whether our main finding regarding Hypothesis 1 was robust to including several control variables that may have plausibly affected HCC. For example, hair washing frequency did not have a significant influence (Table 3). This analysis suggests that the quadratic effect of years of experience, which we hypothesized and found, was not an artefact of any of these potential confounders. As mentioned above, several consultants had substantially higher HCC than the others. Thus, to explore whether our main finding regarding Hypothesis 1 depended on these participants, we repeated our analysis after excluding those participants from our sample. In this analysis, there was no significant linear ($b = -5.6$, $SE = 8.0$, $t = -0.7$, $p = 0.486$), nor a significant quadratic effect ($b = 2.9$, $SE = 7.6$, $t = 0.4$, $p = 0.703$), of years of experience. We return to this finding in the Discussion.

Among residents, there was no relationship between years of experience and HCC, nor any influence of sex (t 's < 3.4 , p 's $> .059$) (Figure 1).

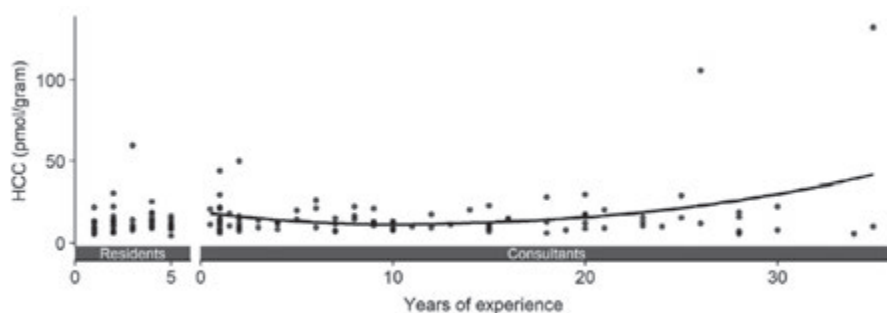


Figure 1. Hair Cortisol Concentration (HCC) of resident and consultant anaesthesiologists plotted against experience.

Table 3. Results from robustness analysis hypothesis 1

Term	b	SE	t	P
Sex (= Male)	1.4	4.6	0.3	0.755
Dyed hair	10.1	4.7	2.2	0.034
Intense transpiration	7.5	3.9	1.9	0.060
Hair product use	1.5	3.5	0.4	0.669
Hair washing frequency				
less than once per week	<i>baseline</i>			
1-2 times per week	0.1	6.1	0.0	0.989
3-4 times per week	2.1	6.1	0.3	0.737
>4 times per week	-6.0	6.2	-1.0	0.336
Corticosteroid use	-1.2	3.7	-0.3	0.748
Years of experience (linear)	40.3	18.0	2.2	0.028
Years of experience (quadratic)	56.3	16.1	3.5	0.001

Hypothesis 2: Trait emotional intelligence and hair cortisol

We found no support for our hypothesis, as trait emotional intelligence did not significantly predict hair cortisol ($b = -0.6$, $SE = 2.2$, $t = 0.3$, $p = .786$). The effect of sex was again not significant either ($b = -1.5$, $SE = 2.6$, $t = -0.6$, $p = 0.571$).

Other analyses

To explore potential explanations for the pattern we found for consultants, we examined how sources of stress vary in relation to years of experience (Figure 2). When using the effort–reward ratio as an outcome variable in consultants, we found there was no significant linear effect of years of experience ($b = 0.6$, $SE = 0.4$, $t = 1.4$, $p = 0.161$). But again, as figure 2 shows, there was a significant quadratic effect of years of experience ($b = -1.3$, $SE = 0.4$, $t = -3.4$, $p = 0.001$). Specifically, according to our statistical model, effort–reward imbalance peaked at ± 17 years of work experience as a consultant. We found no effect of sex ($b = -0.1$, $SE = 0.1$, $t = -1.8$, $p = 0.070$). These predictors together explained 15% of the total variance in effort–reward ratio. For residents, we found that indicated effort–reward ratio linearly increased during training ($b = 0.6$, $SE = 0.2$, $t = 2.7$, $p = 0.010$). This model explained 17% of the total variance in effort–reward ratio.

In separate analyses we explored chronic stress originating from the home situation among consultants by using positive and negative HWI as outcome

variables. In neither analysis, we found significant linear nor quadratic effects of years of experience ($t_s < 1.6$, $p_s > .127$).

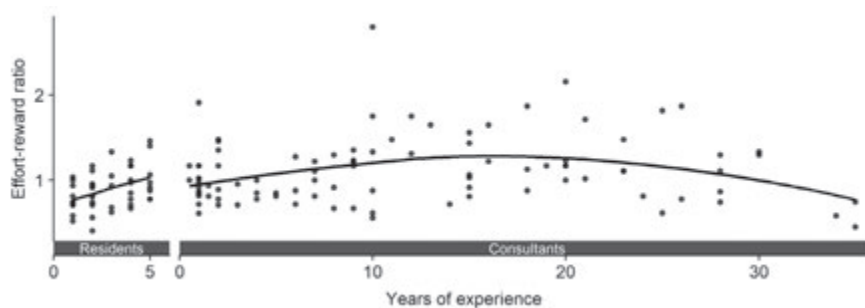


Figure 2. The effort-reward ratio of resident and consultant anaesthesiologists plotted against experience.

DISCUSSION

To our knowledge this is the first study examining hair cortisol concentration in anaesthesiologists. The mean values for HCC we found in anaesthesiologists compare favourably to HCC in individuals suffering from chronic stressors reported in literature.[12] However, in our sample, several consultants in the beginning and later phases of their career did show high levels of HCC, indicating chronic stress and allostatic load. Because of these individuals' high HCC values we found a curvilinear relationship between HCC and years of experience in consultant anaesthesiologists. This finding suggested that, on average, chronic physiological stress was relatively high in the beginning of the career, then decreased until approximately 11 years of work experience, and then increased again.

A curvilinear relationship between age and HCC has previously been reported in the literature. In a sample with ages ranging from 1-91 years HCC was found to be higher in both young children and seniors.[29] On the other hand a meta-analysis showed HCC only to have a small positive linear correlation to age.[27] We found a significant curvilinear effect predicting 14% of variance in a sample with a much smaller age range. For this reason, we believe our finding is not an artefact of commonly found relationships between age and HCC. Rather, we suggest that the effect we found is due to variation in work experience. In line with this idea another study found higher allostatic load towards the end of people's careers.[30]

In residents the effort–reward ratio increased during the years of training, while in consultants we found a curvilinear relationship between effort–reward ratio and

years of experience. Intriguingly, and by contrast to our findings regarding HCC, this source of perceived psychological stress peaked among mid-career consultants, when they had approximately 17 years of work experience as a consultant. Speculatively, this finding can be explained from the fact that mid-life may be a period where one realizes a sense of time limitation and a future that is not anymore one of unlimited possibilities.[14] However, people generally tend to become more positive when they transition into older adulthood due to prioritizing different goals rather than seeking new experiences.[31] For this reason, it makes sense that effort–reward balance improves again among late-career anaesthesiologists.

We did not find the hypothesized relationship between trait emotional intelligence and HCC. Neither did we find a strong relationship between chronic physiological stress as indicated by HCC and psychological stress as indicated by effort–reward imbalance. The discrepancy between measures of physiological stress and psychological stress or personality seems to be counterintuitive. However we should note that dissociations between biomarker measures of stress and self-reported measures of stress and/or personality are frequently reported in the literature.[12] An explanation could be that, by contrast to psychological stress, physiological stress does not per se have a positive or a negative evaluation. Indeed, some individuals psychologically thrive under stress, while others perish.[32] This idea is consistent with our earlier work, in which we found substantial individual differences in the way anaesthesiologists appraised work-related stressors.[33]

It also might be the case that some individuals with personality traits that predispose for experience of psychological stress, have blunted cortisol responses. [34, 35] Reasoning along these lines would mean that, in some individuals, a low HCC could indicate physiological stress as well. Other possible reasons for the discrepancy between physiological and psychological stress could be related to biases concerning questionnaires, such as recall bias and social desirability bias.[36] However this would mean that personalities with blunted cortisol responses and recall bias and/or social desirability bias should peak mid-career among anaesthesiologists, which seems implausible.

An important limitation to our study is, as mentioned, that the relationship between HCC and career phase depended on a small number of anaesthesiologists who had high HCC. A second major limitation of the study is the lack of a control group, for example, a sample of physicians from another specialty and from the general population. Third, because our study has a cross-sectional design, we cannot make strict causal claims. Because of these limitations, our findings must be

interpreted cautiously. A strength of our study is that data obtained from the Dutch Anaesthesia Society showed that the conference attendees who participated in the study, were not so different from non-participating attendees. They were similar in consultant-to-resident ratio, and were similar in terms of the type of hospitals they worked at. However, the male-to-female ratio was different; relatively more female colleagues participated. This is probably caused by that conference attendees could only participate if they had >3cm of hair. Despite this last difference, we find that as far as these variables are concerned, our study participants constitute a representative sample of attendees, which constituted a significant part of Dutch anaesthesiologists. A further strength of our study is that all samples and measurements were taken in the same short period of time and by that public major life events are eliminated or shared. Also, we examined the influence of home on work stress and by that made it plausible the stress we measured to be caused by work. Finally HC/MS/MS, the method of HCC determinations we used is considered a gold standard because of its preciseness.[37]

Because health status is related to allostatic load, future studies should be aimed at quantifying allostatic load and subsequent mental and physiological health status in anaesthesiologists.[38, 39] HCC should be used as one of the parameters of allostatic load and factors like age, sex, career phase, perceived work stress and moderation by personality should be taken into account.

In summary, most anaesthesiologists show low physiological stress. However, some do show high hair cortisol values, and these seem to especially occur late in anaesthesiologists' careers. The physiological stress response is not necessarily mirrored by psychological stress (e.g., due to an unfavorable effort–reward ratio). This finding suggests that the negative health consequences of chronic physiological stress might go unnoticed because they are not always accompanied by negatively perceived psychological stress.

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Appendix 1: Sample preparation and LC-MS/MS method for cortisol in hair samples.

COR was analyzed by LC-MS/MS after grinding hair samples followed by extraction (SLE/SPE). A nine-point calibration series was prepared (Sigma Aldrich), aliquotted and stored at -40 °C until analysis. Every run one aliquot per calibration point was used. Calibrators, in-house QCs as well as samples were prepared in duplicate. Hair was washed in dichloromethane and dried. It was weighed, immersed in methanol and internal standard [$^{13}\text{C}_3$]-COR (Isosciences, King of Prussia, PA) was added before grinding (MM400 Mixer Mill) for 2 hours at 20 hz and subsequent overnight incubation on a rotation wheel. Thereafter cortisol was extracted from the supernatant by supported liquid extraction using 1ml Biotage Isolute® columns and solid phase extraction using Oasis® HLB 1cc cartridges (Waters Corp). Columns were pre-equilibrated with 1 mL methanol:isopropanol (95:5) and subsequently washed with 1 mL H₂O. After application of the sample, columns were washed 2 times with 1 mL H₂O, 1ml water + 2% formic acid, 2 times with 1 mL methanol:H₂O(10:90), 1ml methanol: water (30:70) and 0.5ml methanol: water (40:60) + 5% NH₄OH. The 300 µL eluate methanol:isopropanol (95:5) was dried under a stream of N₂ gas, reconstituted in methanol:H₂O (30:70) and injected (20 µL) into an Agilent Technologies 1290 Infinity VL UHPLC-system (Agilent Technologies, Santa Clara, CA) equipped with a BEH C18 (1.7µm 2.1 X 50mm) analytical column (Waters Corp.) at 60°C. Mobile phase A (methanol:water 20:80 + 2 mM NH₄CH₃COO + 0.1% formic acid) and B (methanol:water 98:2 + 2 mM NH₄CH₃COO + 0.1% formic acid) were run in a gradient (0.4 mL/min). The gradient program was as follows: Start gradient 70:30 A:B for 2.5 min; then to 60:40 A:B in 2 min; followed by a gradient in 2.5 min to 35:65 and a subsequent gradient in 0.5 min to 2:98 to remain such for 0.5 min and thereafter to 70:30 A:B in 0.5 min and remain such for 0.5 min. Retention time was 1.5 min with a total run time of 9 minutes.

An Agilent 6490 tandem mass spectrometer (Agilent Technologies) was operated in the electrospray positive ion mode, with a capillary voltage 3.5 kV, fragmentor voltage 380 V, sheath gas temperature 350°C and gas temperature 150 °C with N₂ collision gas. Two mass transitions were monitored for both cortisol and its internal standard. The first transition was used for quantification, the second for confirmation. The transitions (Q1>Q3), collision energy (between brackets) and dwell time were m/z 363 > 121 (25 eV) and m/z 363 > 97 (34 eV) for COR (50 ms); m/z 366 > 124 (25 eV) and m/z 366 > 100 (35 eV) for [$^{13}\text{C}_3$]-COR.

Ion suppression was assessed by continuous infusion of the cortisol internal standard and the abundance was compared between a hair matrix and mobile phase

at the retention time of the steroid. For cortisol this was 2,3%. Within and between assay imprecision was 4,8% and 8,7% respectively at a level of 14,5 pmol/g assessed by adapted CLSI EP5 protocol with a homogeneous hair sample and based at duplicate measurements ($n = 11$); the LLOQ was assessed from diluted pooled hair samples at the estimated concentration by between assay repeated measurements ($n=5$) and defined as lowest value with an inter-assay CV of 20% and less than 10% bias from the undiluted sample and was 0,55 pmol/g. Recovery of cortisol was calculated from an addition experiment in 6 pooled hair samples (addition of 0.5 – 700 nmol/L) and was between 93 – 103%.

CHAPTER

STRESS LEVELS IN ANAESTHESIOLOGISTS: EXPLAINING THE EXTREMES -Reply to letter to the editor

R.A.B. van der Wal, E. Bijleveld, A.E.v. Herwaarden, M.J.
Bucx, J.B.Prins, & G.J. Scheffer. Reply to Stress levels in
anaesthesiologists: explaining the extremes. European
Journal of Anaesthesiology 2022; 29(3), 294-295

Dear Editor,

We thank Bhakta et al. for showing interest in our paper 'Chronic stress indicated by hair cortisol concentration in anaesthesiologists and its relationship to work experience and emotional intelligence'[1] and for acknowledging the importance of occupational wellbeing of anaesthesiologists. In their letter, Bhakta et al. wondered whether extreme forms of physical exercise or the use of relaxation techniques, such as yoga or mindfulness, were characteristic of the respective high and low values of hair cortisol concentration (HCC) that we observed.

In our study, we did not collect data on participants' physical activity habits, nor on other leisure-time activities. So, we cannot answer Bhakta et al.'s question directly. However, we agree that a more detailed look into the extreme values in our sample could be informative. We did not observe extremely low values of HCC; in fact, most participants displayed low HCC. However, two early-career consultants and two late-career consultants showed relatively high HCC values (>40 pmol/g; Figure 1).

Both early-career consultants, who displayed high HCC, were under 40 and female. Both worked 80–90% of a fulltime job in a general or community hospital. They spent at least 80% of their worktime doing clinical work. Both had a partner and had children living at home. They reported a modest amount of negative home-work interference; nevertheless, for both, home-work interference was high compared to other consultants in our cohort ($\geq 87^{\text{th}}$ percentile). Both were part of the 13% minority of our sample that did not work night shifts.

Both late-career consultants, who displayed high HCC, were over 60. One was male, the other was female. Both worked fulltime in a general hospital and spent at least 80% of their worktime doing clinical work. Both had a partner; neither had children living at home. They reported small amounts of negative home-work interference (23–68th percentile). Both worked night shifts.

Although these characterizations are not uncommon for others in their age group, they are consistent with the possibility that high HCC levels in our sample stemmed from an intersection of work characteristics, home situation, career phase, and physiological characteristics (e.g., sensitivity of the hypothalamic-pituitary-adrenal axis). That said, we cannot rule out Bhakta et al.'s novel hypothesis that high HCC values may also be linked to extreme forms of physical activity.

In their letter, Bhakta et al. suggest that a culture of extreme physical activity seems to be deeply embedded in the anaesthesia community. Perhaps they are correct: though we work in a different region than Bhakta et al., we too know many anecdotes of anaesthesiologists who engage in extreme activities, such as scuba

diving, skydiving, (para)gliding, kitesurfing, racing or martial arts. Another example would be our Australian colleague Richard Harris: an experienced cave diver, who played a pivotal role in the 2018 Thailand cave rescue.[2] As these are anecdotes, rather than evidence of a pattern, we agree with Bhakta et al. that more research in this area is needed, to benefit anaesthesiologists' well-being, which is important for patients as well.

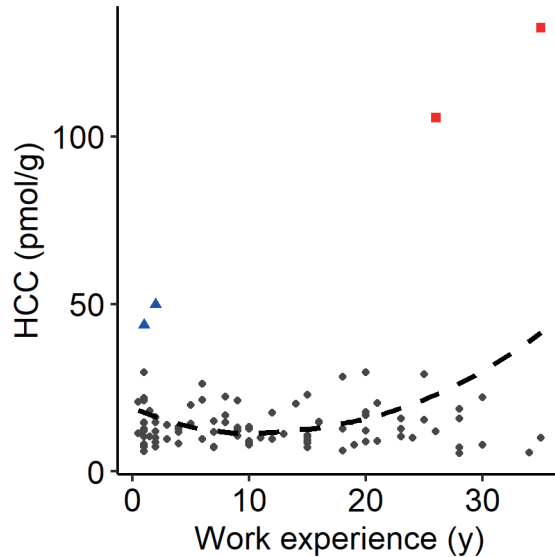


Figure 1. Hair cortisol concentration as a function of years of experience as a consultant anaesthesiologist. Blue triangles indicate the two early-career consultants described in this letter; red squares indicate the two late-career consultants.

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6

CHAPTER

GENERAL DISCUSSION AND FUTURE
PERSPECTIVES

GENERAL DISCUSSION

In the following chapter, first the general aim and the research questions of this thesis are reviewed. Subsequently the main findings of this thesis and their implications are discussed. Then methodological issues related to our research and future research perspectives are considered. Finally, and returning to the general aim, this chapter will conclude with a profile of personality characteristics that would be advantageous for the well balanced anaesthesiologist for coping with stress and staying resilient.

GENERAL AIM AND RESEARCH QUESTIONS

The objective of this thesis is to identify personality traits or combination of personality traits that are advantageous in the stressful high-demand/high-stakes anaesthesia environment. To meet this general aim, four research questions were formulated: 1. What is the existing knowledge concerning personality in anaesthesiologists? 2. Is there a relationship between personality and stressor appraisal in anaesthesiologists? 3. How significant is the chronic stress response in anaesthesiologists? 4. Is there a relationship between personality and chronic stress response in anaesthesiologists?

In chapter 2 we reviewed the literature of existing knowledge of anaesthesiologists' personality. The findings of the different studies were synthesized in terms of the Five Factor Model (FFM). Then in chapter 3 we explored the relationship between stress appraisal and personality in a sample of anaesthesiologists. In chapters 4 and 5 we examined the occurrence of chronic psychological and physiological stress response in anaesthesiologists. Finally in chapters 4 and 5, we explored the relationships of psychological and physiological stress response with personality.

MAIN FINDINGS

1. There is no indication that the personalities of physicians of different medical specialties are meaningfully different (Chapter 2).
2. Personality in general, and certain traits specifically, are moderately but meaningfully related to performance in anaesthesia (Chapter 2).
3. Personality is related to appraisal of work stress and satisfaction in anaesthesiologists (Chapter 3).
4. Some anaesthesiologists show problematic psychological or physiological chronic stress responses (Chapter 4b and 5).
5. Personality is related to psychological stress responses in anaesthesiologists (Chapter 4).
6. There is no evidence that trait emotional intelligence is related to chronic

physiological stress responses in anaesthesiologists (Chapter 5).

7. Psychological and physiological stress responses in anaesthesiologists are not necessarily linked (Chapter 5).

Finding 1: No indication for meaningful differences in personality between physicians of different specialties (Chapter 2)

In the medical world it is a persistent and popular belief that differences in personality between physicians from different specialties must exist.[1] From the perspective of personnel selection, it is an attractive idea to use personality testing as a means of differentiating people into supposedly the most fitting specialties for them. However, our synthesis of psychometric research in anaesthesia did not show differences in personality between anaesthesiologists and physicians from other medical specialties. This is in agreement with recent studies that failed to demonstrate meaningful differences between physicians in general.[2, 3] Therefore, we conclude that there is no evidence for meaningful differences in personality between medical specialties, and that personality testing should not be used as grounds for personnel selection into specialties. Research aimed at finding differences in personality between medical specialties only makes sense when aimed at debunking stereotypes.[4]

If there is no convincing evidence of differences in personality between the several specialities, one might ask why this belief persists. Possibly the perceived differences arise from behaviours that develop as a part of physicians' conceptions of professional role identities (e.g. 'I am a surgeon/anaesthetists/ internist and this is how they should behave').[5] In that respect (although changing over the years) there is also a perceived image and thereby a supposed personality of the anaesthesiologist. In early studies, the typical anaesthesiologist is described as intelligent, assertive, and conscientious; but also as reserved, not very social, and sometimes even as a loner. This may reflect the perceived role (by other physicians/ by themselves) as some kind of high-level technician, sitting behind the anaesthesia machine, not talking to the patient and in a subservient position to surgeons.[6] However, in later studies, the perception of the anaesthesiologist's personality changes positively.[7] This change corresponds deservedly to recognition of the anaesthetist's role as an important member of the (medical) team and as team leaders in patient safety.[8, 9] In sum, although anaesthesiologists are sometimes characterised as having a specific personality, the typical anaesthesiologist personality does not exist: Anaesthesiologists do not differ essentially from other physicians.

Finding 2: Personality in general, and certain traits specifically, are moderately but meaningfully related to performance in anaesthesia (Chapter 2).

In our synthesis of anaesthesia literature, consistent relationships between personality traits and performance were found: good performance and stress-resilience is predicted by lower Neuroticism, higher Extraversion, higher Openness, and higher Conscientiousness. The trait of Openness seems to be less important. The effect sizes were moderate, but meaningful. This is consistent with literature outside of anaesthesia.[10] The same combination of personality traits predicting good performance in anaesthesia were also found to predict good performance and stress-resilience in other medical specialties. And, perhaps surprisingly, also in other high-demand/high-stakes professions outside of the medical realm such as aviation.

Finding 3: Personality is related to stress appraisal in anaesthesiologists (Chapter 3)

Because of concerns about consequences for health, stress became a topic of interest in our literature in the mid-nineties. It was then suggested that personality is also of interest from the perspective of stress.[11] However, the research agenda of personality and stress in anaesthesiology was not as extensively pursued as the topic of stress and its correlates. With our research we aimed to contribute to filling this gap.

We found two personality profiles, a profile of individuals combining high Neuroticism and low Extraversion and a resilient profile. These consistently evaluated occupational stressors and occupational satisfaction differently: individuals from the first profile both evaluated their stressors higher and their satisfaction lower than individuals with the resilient profile. This causes a double effect of increased work stress while the positive and therefore protective effects of work satisfaction are attenuated. Earlier studies in anaesthesiologists which hinted at this phenomenon did not use the five factor model of personality but used other measures of personality, for example, type-B behaviour patterns.[11, 12] Our findings are consistent with relationships known from psychological research. People high in Neuroticism are predisposed to experience negative emotions and perceive events as more stressful, while being high in Extraversion is related to positive challenge appraisal.[13] Our findings could have implications for selection purposes; we will return to that later in this chapter.

Finding 4: Some anaesthesiologists show problematic chronic stress response (Chapter 4b and 5)

To further explore the relationships with personality, it needed to be established in whom chronic stress response is problematic. Therefore, we examined the chronic psychological and physiological stress response in anaesthesiologists. We found that about one out of five anaesthesiologists met the criteria for burnout and that about 40% of anaesthesiologists displayed problematic symptoms of psychological stress. Both numbers are reason for concern. Although it was higher than the average Dutch working population, we found the prevalence of burnout compared favourably to burnout reported in anaesthesia literature.

Chronic physiological stress is accompanied by higher levels of hair cortisol concentration. Indeed, some anaesthesiologists did show problematic values: several consultants in the beginning and especially in the later phases of their career showed high hair cortisol concentration, indicating chronic stress. However, on average, the levels we found in anaesthesiologists compared favourably to those suffering from chronic stressors reported in literature.[14].

Luckily most anaesthesiologists show favourable chronic stress responses, but some do not. That means that these colleagues are at risk. The chronic stress response is important because of the possible negative physical and psychological health consequences. These negative health consequences of chronic stress are known as allostatic load. However, in what way burnout contributes to allostatic load, is not yet completely clear. We will return to this issue in the future perspectives section.

Finding 5 & 6: Personality is related to psychological stress response in anaesthesiologists but no evidence was found for a relationship between trait emotional intelligence and physiological stress response (Chapter 4b and 5)

We found a significant effect of personality on psychological stress response. Neuroticism is the most important factor increasing the risk for presence of psychological distress and presence of burnout. We found Extraversion being the most protective factor for burnout. These findings are consistent with the previous literature.[15]

Exploring the relationships between the five factors of personality and the three dimensions of burnout in more detail, we found only a small protective effect for Conscientiousness in the burnout dimension concerning work accomplishment, this finding is consistent with previous research.[15] However, in our analysis for stress

appraisal and psychological distress we did not find that effect for Conscientiousness. Theoretically Conscientiousness is related to stress response. Conscientiousness is about attitude to work and achievement and is strongly related to coping because people high in conscientiousness engage in planning and active problem solving while being low on conscientiousness predisposes for bad time management and passive maladaptive coping.[16]

Summarizing, concerning stress appraisal and psychological stress reaction lower Neuroticism and higher Extraversion are favourable. Higher Conscientiousness is probably important as well.

The found FFM traits thus far are useful and meaningful but also rather general. For this reason research should aim at identifying more narrow predictors for specific outcomes that have incremental validity above the Big Five Model as a criterion. [17] One of those more narrow predictors could be emotional intelligence. In recent anaesthesia related literature it has been suggested that emotional intelligence has positive implications for leadership and overall performance.[18, 19] Trait emotional intelligence (TEI) is a consistent concept within the framework of trait psychology. TEI aims at gathering affect-related traits that are scattered throughout the five dimensions of the FFM. TEI showed incremental validity in explaining a number of responses and emotional behaviours above the established BFM.[20, 21]

We hypothesised that trait emotional intelligence would be related to chronic physiological stress response in anaesthesiologists. However in our research we did not find such a relationship. Perhaps trait emotional intelligence is not the best predictor for physiological stress occurrence and the broader FFM would be more applicable for this specific outcome. It is possible that other traits than those that are affect-related have predictive value when concerning physiological stress.

Finding 7: Psychological and physiological stress responses are not necessarily linked in anaesthesiologists (Chapter 4b and 5)

The above finding means that a tendency to negative emotionality does not necessarily lead to increased chronic physiological stress and the other way around. Furthermore, in our research we did not find a relationship between stress as measured with effort-reward imbalance and chronic physiological stress. This discrepancy means that physiological stress is not necessarily mirrored by negative experienced psychological stress. Indeed it is important to note that physiological stress response is not always accompanied by a change in subjective feelings.[22] For example the experienced skydiver will experience the same physiological stress

response as the inexperienced, but with less anxiety.[23]

Still, the psychological component of the stress response is often regarded to be one of negative emotionality, while this is not necessarily the case.[24] We have to keep in mind though that the stress response is an adaptive response and as such neither negative nor positive. For example, when the stressor is perceived to be a challenge, and resources are sufficient, the emotional component of the stress response may be positive. However, when the stressor is evaluated as a threat and imbalance between demands and resources is perceived, the stress response may be accompanied by negative emotions or avoidance behaviour.

In other words, one can have a physiological stress response but with a positively appraised psychological stress response; thrill vs anxiety. For example, complex caseload but within the expertise and skill level of the anaesthesiologist may cause a physiological stress response but with positive emotions. Implications are however that individuals can build up allostatic load with a subsequent risk of ill-health effects without being warned by negative emotionality like anxiety, depression or burnout.

METHODOLOGICAL ISSUES

There are some methodological issues related to the research methods we used in this thesis. First, to measure personality and burnout as a measure of mental health we used self-report questionnaires. Compared with other methods of assessment, such as for example structured psychiatric interviews or behavioural observations, the use of self-report questionnaires has the advantage, larger samples can be assessed and statistically analysed. However, in self-report questionnaires responder bias and social desirability biases may occur. Nevertheless, self-report questionnaires have been validated by assessing their convergence with other measurements of personality and behaviour, such as reports by others.[25, 26]

Second, to describe personality we used the Five Factor Model. The mutually exclusive five factors are statistically derived and for this reason the FFM has the advantage of providing a comprehensive framework of psychological traits. However, increasing bandwidth by generalizing personality in these five broad traits also means decreasing fidelity and thereby perhaps loss of nuance in description of personality. [27] On the other hand, the main advantage of the Five Factor Model is that it enabled us to compare the outcomes between studies that used different instruments.

Third, to assess physiological chronic stress, we used the measure of hair cortisol concentration. This method has the advantage that by taking just one sample

of hair it can retrospectively be used as a biological measure of chronic stress and allostatic load.[14] However, dissociations between biomarker measures of stress and self-reported measures of stress and/or personality are frequently reported in the literature.[14] Still, the use of both self-report and biological stress measures should give complementary information especially from the perspective of stress response as an health issue.

Fourth, we used cross-sectional methods which prevent from drawing causal relationships, which would be possible with a longitudinal or an experimental approach. For this reason, based on our research, it is not yet possible to formulate or to identify preventive measures or interventions that would potentially increase stress resilience among anaesthesiologists with certain personality profiles. However, our research could be used to identify those colleagues that would potentially benefit from individualized measures. This could be a starting point of longitudinal research, if combined with structural strategies aimed at improvement of e.g. burnout.[28]

Fifth, we did not differentiate between male and female anaesthesiologists although cross-cultural research regarding personality traits shows some patterns of gender differences.[29]

FUTURE PERSPECTIVES

This thesis highlights several key challenges for future research. These should not only focus on the perspective of the anaesthesiologist but should also take into account the interests of the patient. From either perspective, good performance and well-being of the anaesthesiologist is adamant.

The first key challenge for future research is to further improve our ability to predict job performance among anaesthesiologists. Because numerous meta-analytic studies have demonstrated that personality measures contribute to prediction of job performance, personality measures may have a place here.[30] Therefore the challenge is more specifically: 1. the choice of the personality measure, in relationship to: 2.a performance criterion of interest. This should be based on expected conceptual or theoretical relationships between the personality predictor and the performance criterion.[30] Concerning the choice of an appropriate personality measure, as said, the personality factors of the FFM are broad and the effect sizes with performance are moderate. Therefore, we have to identify a narrow, more specific measure of personality that has incremental validity over the FFM. Concerning the performance criterion of interest, stress resilience should, in the context of anaesthesia, be a reasonable choice.

The second important challenge is to improve the monitoring and prediction of well-being in anaesthesiologists. This is important because it is known that anaesthesia-related stress not only has effects on mental, but on physical health as well.[31-33] This thesis also shows that chronic stress can manifest in several ways: psychologically and physiologically. In order to accomplish this challenge, first cross-sectional and later follow up correlational studies should be done in which: 1. Occupational stressors in anaesthesiologists are assessed and 2. an allostatic load index for anaesthesiologists is determined. An allostatic load index is a measure of the wear and tear that the body experiences because of repeated physiological responses to psychosocial stress.[34] In this index also psychological stress syndromes such as burnout could have a place.[35, 36]

Furthermore, the behavioural components of chronic stress response should be further investigated. Expanding knowledge should be used to identify in which stage of their careers, which colleagues are at risk and then to take preventive measures, personalized but also on the organisational level.

A major opportunity for research in anaesthesia is to better use existing knowledge from other professions, especially those professions in which employees have to perform well under high stakes/high demands conditions. The future direction should be that research into the predictive validity of personality on performance measures or psychological resiliency, done by or in other disciplines is used. Possible ways are: The findings (from other areas) can serve as a starting point for a next stage of research in anaesthesia. Also, cross-validating findings between different occupational areas, especially because replicability of findings increases the level of evidence.

Cooperation with occupational psychologists should be intensified. This would also prevent well-meaning anaesthesiologists using non-validated or psychometrically controversial measures, such as the Rorschach Inkblot test and Meyers Briggs Type Indicator for personality or the Bar-On Emotional Quotient Inventory for emotional intelligence. Within this field a wealth of expertise is already available that could be translated to anaesthesia requirements. It has been demonstrated that traits and abilities favourable for anaesthesiologists are probably the same for other high stakes/ high demand professions. In the same way, anaesthesia is a valuable research partner for other high stakes/high demand professions. For example, anaesthesia simulations provide a stress model with a high ecological validity and could be used to perform stress research that otherwise would have been done in more abstract laboratory stress models.

CONCLUSION

Based on the review of the anaesthesia literature and our empirical studies, a profile of advantageous personality traits for anaesthesiologists can be formulated.

The well-balanced anaesthesiologist is:

Lower on Neuroticism, which means having a stable emotionality. This is favourable in stress handling both in acute and chronic situations. People lower on Neuroticism are less frequently bothered by stress caused by daily hassles and conflicts. In contrast, individuals higher on Neuroticism have the tendency to worry and ruminate and Neuroticism is associated with seeking inadequate social support.

Higher on Extraversion. Individuals high on this trait will generally have positive emotionality especially in a social context. People high on Extraversion will be outgoing and sociable as opposed to withdrawn and reserved. This is favourable both in stress and work performance. After all, anaesthesia is a team effort.

Higher on Conscientiousness. Conscientiousness is about attitude to work and achievement. People high in conscientiousness engage in planning and active problem solving while being low on conscientiousness predisposes for poor time management and passive maladaptive coping. There is a possible relation with obsessive traits which might be important in performance. Afterall, in anaesthesia vigilance and eye for detail are vital.

Because stress is inherently a part of practicing anaesthesia, it is not surprising that the same combination of personality traits predicts not only good performance but also resiliency to psychological stress.

FINAL THOUGHT

In 1978 Coombs described anaesthesiology as ‘the most exact art in science’ because anaesthesiology is concerned with keeping the patient ‘from responding to the surgeon’s knives, while simultaneously keeping the patient from dying’. This statement still holds truth; anaesthesia is an art and a science at the same time. And yes, it needs a special kind of person to practice this art. But we have to keep in mind, that anaesthesiologists are special in exactly the same way good surgeons, good internists or good paediatricians are special. A good doctor is a good doctor – and that is what matters most to the patient.

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CHAPTER

SUMMARY

7A

The topic of this thesis is the personality of anaesthesiologists in relation to the stressful nature of their profession. The general aim is to identify those personality traits that are advantageous for anaesthesiologists, especially when confronted with occupational stressors.

The research questions are:

1. What is the existing knowledge concerning personality of anaesthesiologists?
2. Is there a relation between personality and appraisal of occupational stressors in anaesthesiologists?
3. How significant is the chronic stress response in anaesthesiologists?
4. Is there a relation between personality and chronic stress response in anaesthesiologists?

We performed a systematic review of the literature on the topic of personality of anaesthesiologists. Also we performed a national survey among anaesthesiologists in which we used validated instruments to assess personality, burnout, psychological distress and occupational stress. Finally in a sample of anaesthesiologists, we measured hair cortisol concentration, a measure of chronic physiological stress, and used a validated instrument to assess emotional intelligence.

The main findings are:

1. There is no indication that the personalities of physicians of different medical specialties are meaningfully different (Chapter 2).
2. Personality is moderately related to performance in anaesthesia (Chapter 2).
3. Personality is related to appraisal of work stress and satisfaction in anaesthesiologists (Chapter 3).
4. Some anaesthesiologists show problematic psychological or physiological chronic stress responses (Chapter 4b and 5).
5. Personality is related to psychological stress responses in anaesthesiologists (Chapter 2 and 4).
6. There is no evidence that trait emotional intelligence is related to chronic physiological stress responses in anaesthesiologists (Chapter 5).
7. Psychological and physiological stress responses in anaesthesiologists are not necessarily linked (Chapter 5).

These findings implicate that: personality testing aiming to match residents with for them fitting specialities does not make sense. Furthermore because relationships with personality are moderate, using personality testing to predict performance, work stress and mental health should (if) used, be accompanied with other measures. Because some anaesthesiologists show problematic psychological or physiological stress response, and because these are not necessarily linked, individuals can build up allostatic load with a subsequent risk of ill-health effects without being warned by negative emotionality like anxiety, depression or burnout. For this reason both organizational and personalized interventions aimed at alleviating work stress should be implemented.

This thesis concludes that the well balanced anaesthesiologist is: Lower on Neuroticism, which means having a stable emotionality. This is favourable in stress handling both in acute and chronic situations. Higher on Extroversion. Individuals higher on this trait will generally have positive emotionality especially in a social context. People higher on Extraversion will be outgoing and sociable as opposed to withdrawn and reserved. This is favourable both in stress and work performance. After all, anaesthesia is a team effort. Higher on Conscientiousness. Being low on conscientiousness predisposes for poor time management and passive maladaptive coping while people higher in conscientiousness reduce work stress by engaging in planning and active problem solving while. This is important in anaesthesia where vigilance and eye for detail are vital.

CHAPTER

SAMENVATTING (NL)

7B

Het onderwerp van dit proefschrift is de persoonlijkheid van anesthesiologen in relatie tot hun werk en de stress, die een belangrijk onderdeel van dat werk is. De algemene doelstelling van dit proefschrift is om die persoonseigenschappen te identificeren die voor anesthesiologen gunstig zijn, met name wanneer zij geconfronteerd worden met werk gerelateerde stress.

De onderzoeksvragen zijn:

1. Wat is de bestaande kennis voor wat betreft de persoonlijkheid van anesthesiologen?
2. Is er een relatie tussen persoonlijkheid van anesthesiologen en hun psychologische waardering van beroeps gerelateerde stressoren?
3. Hoe belangrijk is de chronische reactie op stress bij anesthesiologen?
4. Is er bij anesthesiologen een relatie tussen persoonlijkheid en chronische reactie op stress?

Om deze vragen te beantwoorden werd een systematisch review van de literatuur met als onderwerp persoonlijkheid van anesthesiologen verricht. Ook werd er een landelijk vragenlijst onderzoek gedaan waar met gevalideerde instrumenten persoonlijkheid, burn-out, psychologische distress en beroeps gerelateerde stress werden gemeten. Tot slot is er bij een groep anesthesiologen de concentratie van cortisol in haar gemeten, als maat voor chronisch psychologische stress, alsmede met een gevalideerd instrument hun emotionele intelligentie.

De belangrijkste bevindingen van dit proefschrift zijn:

1. Er zijn geen aanwijzingen dat de persoonlijkheden van de verschillende medische specialisten wezenlijk van elkaar verschillen (Hoofdstuk 2).
2. Persoonlijkheid is gerelateerd aan functioneren bij anesthesiologen (Hoofdstuk 2).
3. Persoonlijkheid is gerelateerd aan psychologische waardering van werk stress en werk tevredenheid bij anesthesiologen (Hoofdstuk 3).
4. Sommige anesthesiologen hebben een problematische chronische of psychologische stress response (Hoofdstuk 4b en 5).
5. Persoonlijkheid is gerelateerd aan psychologische stress reactie bij anesthesiologen (Hoofdstuk 2 en 4)
6. Er zijn geen aanwijzingen dat emotionele intelligentie als persoonlijkheidstrekk is gerelateerd aan chronische fysiologische stress response (Hoofdstuk 5).
7. Psychologische en fysiologische reactie op stress komen niet per se tegelijkertijd voor bij anesthesiologen (Hoofdstuk 5).

Deze bevindingen betekenen dat het niet zinvol is de persoonlijkheid van kandidaten te testen met als doel te differentiëren naar een voor hun geschikt medisch specialisme. Als persoonlijkheidstests worden gebruikt om prestatie, werk stress en geestelijke gezondheid te voorspellen moet dit gebeuren in combinatie met andere instrumenten, dit omdat de correlatie tussen persoonlijkheid en functioneren weliswaar betekenisvol maar matig is. Sommige anesthesiologen hebben een problematische psychologische of fysiologische reactie op stress maar, omdat deze niet per se tegelijkertijd optreden is het mogelijk dat zij allostatic load opbouwen met de daarbij horende gezondheidsrisico's, zonder hiervoor te worden gewaarschuwd door gevoelens van negatieve emotionaliteit zoals spanningen, burn-out of depressie. Om deze reden zou niet alleen op organisatie niveau maar ook op individueel niveau interventie gericht op het verminderen van arbeid gerelateerde stress moeten worden geïmplementeerd.

Dit proefschrift concludeert dat de evenwichtige anesthesioloog de volgende persoonlijkheid eigenschappen heeft: Lager op Neuroticisme, dit betekent het hebben van een stabiele emotionaliteit. Dit is gunstig in het omgaan met stress zowel in acute en chronische situaties. Hoger op Extraversie. Personen hoger in deze eigenschap zullen over het algemeen een positieve emotionaliteit hebben in sociale context. Deze personen zijn sociaal en houden van gezelschap in plaats van teruggetrokken zijn of gereserveerd. Dit is gunstig zowel voor het ervaren stress als voor het functioneren op het werk: Het geven van anesthesie is per slot van rekening teamwork. Hoger op Consciëntieusheid, mensen die meer gewetensvol zijn zullen beter plannen en kiezen voor het actief oplossen van problemen terwijl personen die lager scoren op deze eigenschap de neiging hebben hun tijd slecht in te delen en op een meer passieve manier met problemen om te gaan. Dit is gunstig voor de anesthesiologie waar oog voor detail en waakzaamheid vitaal zijn.

CHAPTER

DESCRIPTION OF RESEARCH DATA
MANAGEMENT

8

This thesis is based on the results of studies with human subjects. These were conducted in accordance with the principles of the Declaration of Helsinki. Approval for the studies was given by the local ethics committee (Commissie Mensgebonden Onderzoek regio Arnhem-Nijmegen, The Netherlands).

Written information for the studies in chapters 3 and 4 was given, consent was implied by participating in the survey. For the study in chapter 5 written informed consent was obtained.

Privacy of the participants in chapter 3 and 4 was guaranteed by use of unique individual subject codes. The key-file was password protected and held in the TMF. The privacy and anonymity of the participants of chapter 5 was assured by having the informed consent forms stored and locked separately from the anonymized CRF's. Also, for this study, a key-file was *not* made.

For the studies in chapters 3 and 4, data was gathered by the web-based questionnaire application RadQuest. After closure, this database was locked. Standardized scripts were used to prepare the raw data for analysis. The thus generated output data was then presented in a SPSS-file. Further data analysis was performed by the researchers using the statistics programmes SAS 9.2 for Windows (SAS Institute Inc., Cary, NC, USA) and SPSS Statistics for Windows (Version 20.0, IBM Corp., Armonk, NY, USA).

Data for the study in chapter 5 were gathered using uniquely numbered paper CRF's. The corresponding hair samples were numbered accordingly. All paper data was entered into the computer by use of Castor EDC. Data management and monitoring were also performed within Castor EDC. On the output data statistical analysis and data visualization was done in 'R' (version 3.6.1 2019, RStudio Inc, Vienna Austria).

Project data storage for chapter 3 and 4 was done on the server of the medical psychology department of the Radboudumc (H:\Meetinstrumenten\Radquest\RQ 1.0 export\ANES, H:\Onderzoeksprojecten\ANESburnout\4, H:\Onderzoek\4 datamanagement \MPSalg\ANES). Data storage for chapter 5 was done in the physical archives of the science bureau of the anaesthesia department (archivenr. 172, room M333.02.229, closet G) and on the Castor-servers. A copy of the Castor EDC output data is stored on the anaesthesia department server of the Radboudumc (H:\ANES\ResearchAnes\SCAN 19-WAL).

The data will be saved for 15 years after termination of the individual studies. Both datasets were uploaded to the site of the Open Science Framework. Links to the datasets are available on reasonable request.

CHAPTER
CURRICULUM VITAE

9

ABOUT RAYMOND

Raymond van der Wal was born in Grubbenvorst, October 30th, 1974. He completed his secondary education at Nederrijn College in Arnhem. After graduation in 1993, he was not offered a place to study medicine. Instead he was selected for the Dutch Naval Academy where he subsequently spent 2 years as a midshipman. In this time he realised that he was likely better suited to a future in medicine than a career as a naval officer. Unfortunately, after leaving the military, he was again unable to secure a place to study medicine; instead he started training as an operating theatre nurse in the Canisius Wilhemina Ziekenhuis in Nijmegen. After completing this training, Raymond was finally successfully placed to study medicine at Leiden University. In addition to his medical studies and to further explore his interest in the subject, Raymond started to study philosophy at the Radboud University in Nijmegen. During his studies he continued part time work as an operating theatre nurse at the Radboud University Medical Centre Nijmegen (UMCN); at which time he became increasingly intrigued by the work of the anaesthesiologists. After graduating from medicine in Leiden, he transferred to Radboud university to complete his internships; and consequently graduated as a medical doctor in Nijmegen. His first job as a resident was at the ICU in the UMCN. Subsequently he started his training in anaesthesia under the supervision of prof. GertJan Scheffer. In the last year of his residency, Raymond was given the opportunity to be trained as a Helicopter Emergency Medical Service (HEMS) physician. On completion of his specialty training he remained at the Radboud University Center working as an anaesthesiologist and HEMS physician. Raymond then started his PhD-project under the supervision of prof. Judith Prins and prof. GertJan Scheffer, of which this thesis is the result. In 2019 Raymond was promoted to and sworn in as a commander in the Dutch Navy Reserve as a medical specialist. Currently he works as an anaesthesiologist in the Radboud University Medical Center.

Raymond is married and has two daughters.

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- **R.A.B van der Wal**, M.J.L Buxx, JCM Hendriks, G-J. Scheffer, J.B. Prins; Psychological Distress, Burnout and Personality Traits in Dutch Anaesthesiologists: a Survey Study; European Journal of Anaesthesiology 33.3 (2016): 179-186.
- **R.A.B van der Wal**, M.J.L Buxx, J.C.M. Hendriks, G-J. Scheffer, J.B. Prins; Work Related Stress and Satisfaction in Relation to Personality Profiles in a Sample of Dutch Anaesthesiologists. European Journal of Anaesthesiology 2016, 33.11: 800-806.
- **R.A.B van der Wal**, M.J.L Buxx, J.C.M Hendriks, G-J. Scheffer, J.B. Prins Reply to : psychological distress, burnout and personality traits in Dutch anaesthesiologists: European Journal of Anaesthesiology 2017, 34.1: 42-43
- K.B.M.S.L. Leong, M Hanskamp-Sebregts, **RAB van der Wal**, AP Wolff. Effects of perioperative briefing and debriefing on patient safety: a prospective intervention study. BMJ open 2017, 7.12: e018367.
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- **R.A.B. van der Wal**, J. Wallage, G.J. Scheffer, J.B. Prins, E. Bijleveld. Personality in anaesthesiologists, a systematic review of the literature. *European Journal of Anaesthesiology* EJA 39.4 (2022): 378-387..
- **R.A.B. van der Wal**, E. Bijleveld, A.E.v. Herwaarden, M.J. Bucx, J.B.Prins, G.J. Scheffer. Chronic stress indicated by hair cortisol concentration in anaesthesiologists and its relationship to work experience and emotional intelligence: A cross-sectional biomarker and survey study. *European Journal of Anaesthesiology* 2022; 39:26–32
- T. Leow, **R.A.B. van der Wal**, H.A. Marres, J. Honings. Intubation with a TriTube to avoid peri-operative tracheostomy in open airway surgery. *The Journal of Laryngology and Otology* 2022. *The Journal of Laryngology & Otology* 2022: 1-16.
- **R.A.B. van der Wal**, E. Bijleveld, A.E.v. Herwaarden, M.J. Bucx, J.B.Prins, & G.J. Scheffer. Reply to: Stress levels in anaesthesiologists: explaining the extremes. *European Journal of Anaesthesiology* | EJA 39.3 (2022): 294-295

PhD portfolio of R.A.B. van der Wal

Department: **Anaesthesiology, Pain and Palliative care**
 Graduate School: **Radboud Institute for Health Sciences**
 PhD period: **01/07/2016– 01/11/2021**
 Promotor(s): **Prof. G.J. Scheffer, mv. prof. dr. J.B. Prins**
 Copromotor(s): **Dr. M.J.L. Bucx, dr. E.H. Bijleveld**

Training activities	Hours
Courses	
- Qualitative Research Methods and Analysis (2018)	42.00
- BROK (2019)	42.00
- Writing a Review Article (2020)	28.00
- Statistiek voor promovendi met SPSS (opfriscursus) (2020)	56.00
- Radboudumc - Scientific integrity (2020)	20.00
- RIHS - Introduction course for PhD candidates (2021)	15.00
Seminars	
- Oral presentation Dutch congress for emergency care (2016)	5.00
- Oral presentation Radboud Research Round stress (2017)	5.00
- Oral presentation Dutch HEMS congress: Lifeline 3 future. (2018)	5.00
- Poster presentation Radboudumc Anesthesiology Science café. (2018)	5.00
Conferences	
- Annual congress ASA (2016)	20.00
- NVA-Anesthesiologendagen (2017)	16.00
- Congress Emirates society for emergency medicine (2017)	18.00
- NVA-Anesthesiologendagen (2018)	16.00
- NVA-Anesthesiologendagen (2019)	16.00
- Annual congress ASA (2019)	20.00
Other	
- Reviewer Stress and Health Medicine (2017)	8.00
- Reviewer Stress and Health Medicine (2021)	8.00
Teaching activities	
Lecturing	
- Keuzeblok SKMR4-zuurstof (2015)	84.00
- Coach for master students medicine (2017)	50.00
- APLS-instructor (2019)	100.00
Supervision of internships / other	
- Supervisor research internship Master Medicine (2021)	28.00
- Supervisor research internship Master Medicine (2022)	28.00
Total	637.00

CHAPTER

DANKWOORD

10

Zoals velen voor mij: ik ben blij dat het klaar is. Het voltooien van een promotie is een beste onderneming en weerbarstiger dan ik besepte toen ik er aan begon. Los daarvan, er zijn meerdere omstandigheden geweest die hebben geleid tot uitstel en daarmee hadden kunnen leiden tot afstel en dus tot een projectfailliet. Dat is niet gebeurd en gelukkig is er nu resultaat: het 'boekje'.

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