

Personality Differences in Dental Professionals

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Abstract

Title – Personality Differences in Dental Professionals: A Cross-sectional Survey.

Aim – To measure the personality of dental professionals and OMF surgeons and investigate differences between groups.

Design – Cross-sectional survey.

Setting – United Kingdom. Data collected October 2020 to January 2021.

Population – The sample comprised of dental nurses (n = 475), general dental practitioners (GDPs) (n = 182), orthodontists (n = 201) and oral and maxillofacial (OMF) surgeons (n = 48).

Materials and Methods – Participants were recruited via email and social media. The questionnaire collected data on demographic variables and contained the Big Five Inventory, a validated self-report personality test based on the prevailing Five Factor Model of personality. Participants were scored on: Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness, as well as the more specific personality facets of Assertiveness, Activity, Altruism, Compliance, Order, Self-Discipline, Anxiety, Depression, Aesthetics, and Ideas.

Data Analysis – One way analysis of variance and post hoc tests were used to identify significant mean differences between occupations in the five factors and ten facets. Hierarchical multiple regression determined the influence of occupational group, over and above demographic variables, for each of the five factors.

Results – Dental nurses had greater Agreeableness relative to orthodontists ($p = 0.002$) and OMF surgeons ($p = 0.001$). Orthodontists and dental nurses had greater Conscientiousness relative to GDPs ($p < 0.001$). Orthodontists and OMF surgeons had lower Neuroticism relative to dental nurses ($p = 0.002$).

The differences were small to moderate in size ($\omega^2 = 0.025 - 0.047$). Occupation was associated with personality after accounting for demographic variables.

Conclusions – The personalities of dental nurses, GDPs, orthodontists and OMF surgeons differ. Although it is not possible to determine cause and effect from this study design, these differences have implications for teamworking, recruitment, and self-selection into these groups.

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1 Literature Review

1.1 Defining Personality

A lack of one all-encompassing definition for personality is the result of both differing opinions amongst researchers and the complexity of people themselves (Barenbaum and Winter, 2008). A prominent early figure in personality psychology, Gordon Allport, defined personality as “a dynamic organisation, inside the person, of psychophysical systems that create the person’s characteristic patterns of behaviour, thoughts and feelings” (Allport, 1961). This definition makes reference to the relative stability of personality, which is what makes its study possible as it gives rise to behaviour typical of a given person across a variety of situations (Robins et al., 2009).

Research has found specific personality traits to correlate with measures of health, professional performance, and quality of interpersonal relationships (Ozer and Benet-Martinez, 2006). In his review of the literature, Roberts et al. (2007) found personality traits to have an influence on mortality, divorce, and occupational attainment comparable to socioeconomic status and cognitive ability. Perhaps because of this apparent importance of personality, recent years have seen greater application of psychometric personality testing in the recruitment and selection process for occupations and educational institutions (Jenkins, 2001).

Meta-analyses by Barrick and Mount (1991) and Salgado (2003) found personality to predict job performance and there is strong evidence to suggest personality correlates with effective teamworking (Bakker-Pieper and de Vries, 2013, Tett and Burnett, 2003, McGlashan et al., 2004, Peeters et al., 2006). In addition, matching an individual’s personality to their occupation appears to reduce attrition rate and results in higher

levels of job satisfaction (Judge et al., 2002). Despite this, there is a paucity of research investigating personality in dental professionals and how personality may vary amongst different dental occupations remains understudied.

1.2 Types or Traits

When describing personality, either a 'type' or 'trait' approach may be taken. Personality types are discrete categories which encompass a number of characteristics that exist in a binary way (John et al., 2008b). A person is either of that type or is not. For example, they are either extroverted or they are introverted. This approach has drawn criticism as there may be considerable differences between people categorised as being of the same type.

The Swiss psychiatrist Carl Jung described eight psychological types which he identified through his psychoanalytical work (Jung, 1923). The psychoanalytic approach holds unconscious processes to be central in the development and manifestation of personality. Thought processes which the individual is aware of and psychological drives into which they have no conscious insight interact to give rise to a person's temperament and behaviour (Barenbaum and Winter, 2008). The theories of seminal psychoanalysts such as Sigmund Freud have permeated popular culture, and their lasting impact is seen even today in colloquialisms such as the "Freudian slip". Although psychoanalysis continues to be an active field, Freudian theories have largely been abandoned. However, the psychoanalytic approach, particularly the work of Carl Jung, gave rise to one of the most popular personality measures used today, the Myers-Briggs Type Indicator (MBTI) (Myers et al., 1998).

The alternative to the type approach is the trait approach. This is favoured in most contemporary research (John et al., 2008a). A personality trait is a continuous, rather than discrete, dimension that applies to all people. Individuals only vary in the degree to which they demonstrate a given trait and they are considered stable tendencies which manifest across situations and explain a person's behaviour (McCrae and Costa, 1987, Goldberg, 1993)

1.3 Nature or Nurture

It seems intuitive to assume both genetics and environment play a role in determining personality; however, early 20th century theory and research placed almost complete emphasis on the individual's environment (Loehlin, 1992).

More recently, research in behavioural genetics, using twin and adoption studies, has put estimates of heritability at between 0.20 to 0.80, and frequently at 0.50 or greater. A meta-analysis by Vukasović and Bratko (2015) looking at over 50 studies, found the overall proportion of personality differences explained by genetics to be 40%, with the remainder explained by environmental influence.

Nonshared environmental factors are those which differ between siblings, such as different friends or teachers, and these are thought to be particularly important in explaining differences in personality (Bouchard and Loehlin, 2001, Plomin et al., 2001). The influence of environment is itself shaped by genetics, as people's perceptions of their environment are subject to genetic influence. Also, behaviour is in part genetically determined, and a person's environment will change as they interact with it, therefore by extension their genes will alter their environment to some degree. Finally, individuals will gravitate towards environments that suit their genetic

predispositions and so again nature and nurture act in a complex and reciprocal way (Plomin and Bergeman, 1991, Plomin et al., 2001).

1.4 How Much Does Personality Influence Behaviour?

The relative importance of personality traits, compared with an individual's environment, in predicting behaviour has historically been a contentious topic. In a strong criticism of the personality literature of the time, Mischel (1969) argued that differences in personality account for only a small proportion of the variance in behaviour, with an individual's situation having a far greater impact. He argued that since the correlational upper limit between personality and behaviour demonstrated in empirical research was approximately .30, personality traits had limited utility in predicting or explaining behaviour.

Although this modest effect size implies there may be limited value in focusing on personality when attempting to explain or optimise human behaviour, its size does appear to be consistent with modal effect sizes between 0.10 and 0.40 seen in the psychology literature as a whole (Meyer et al., 2001, Robins et al., 2009, Hemphill, 2003). Furthermore, the importance of personality does not only depend on the size of its association with behaviour, but also on how that behaviour influences the most important life outcomes. For example, the fact that meta-analytic work finds higher Neuroticism to be associated with diminished lifespan emphasises the substantial impact of personality traits (Roberts et al., 2007, Soto, 2019). Finally, ostensibly small effects can accumulate over the lifespan. As demonstrated in the work of Hardarson et al. (2001), and confirmed in a review by Roberts et al. (2007), a slightly lower level of Conscientiousness may inhibit individuals from pursuing education earlier in life, thereby impeding their occupational attainment, and having consequences on their

mortality rates later on. Contemporary research therefore gives a more balanced impression of the contribution of personality and situation, and certainly finds personality to be a critical factor in determining key life outcomes (Ozer and Benet-Martinez, 2006, Roberts et al., 2007, Plomin et al., 2001).

1.5 The Five-Factor Model

Decades of research on which traits, when taken together, fully capture personality led to the development of the five-factor model (FFM) (Norman, 1963, McCrae and Costa, 1987, Goldberg, 1993). This model came out of the *lexical approach* which saw researchers analyse all linguistic terms in the English language used to describe personality characteristics. Reduction and categorisation of these terms into groups led to the development of broader trait categories. The major domains of personality in this model are Neuroticism, Extroversion, Openness, Agreeableness, and Conscientiousness. These are termed the Big Five. The FFM is also hierarchical as each of the five domains subsumes lower level facet traits, although there is less agreement on what these lower level traits are (Costa Jr and McCrae, 1995, Soto and John, 2009, Johnson, 2014, Goldberg, 1999).

Support for the FFM comes from factor analyses of personality questionnaires repeatedly yielding the Big Five traits (McCrae and Costa, 1987). Factor analysis is a statistical method used to address the problem of how to analyse the correlations amongst several variables. It does this by attempting to identify a set of latent dimensions underlying these variables. Research using factor analyses has consistently found responses to personality questionnaires describe an individual in terms of the Big Five (McCrae and Terracciano, 2005a, McCrae and Costa, 1987, John et al., 2008a)

Proponents of the FFM model argue that these traits are, to some extent, genetically inherited tendencies that result in predictable behaviour and emotions (Costa Jr and McCrae, 1994, Goldberg, 1981). Despite some early debate on its ability to fully capture and describe personality (Eysenck, 1992), the FFM is the prevailing model in modern personality research and has the greatest empirical grounding replicated across multiple nations and cultures (McCrae and Terracciano, 2005b, McCrae and Terracciano, 2005a). There is also evidence showing correlations between differences in the Big Five and neurostructural variation seen between individuals (Maltby et al., 2010, John et al., 2008b, Liu et al., 2013). Finally, although less developed than the literature on adults, there is some evidence for a five factor structure to personality in children and adolescents suggesting that the Big Five have childhood antecedents and that they may be effective in capturing the nature of personality from the early stages of development through into adulthood (Caspi and Shiner, 2006).

1.6 The Five Factors and Their Development

The development of personality is shaped by a number of inputs including biological, familial, and cultural factors (Caspi and Shiner, 2006). In contrast with adult personality, for which the cohesive taxonomic and theoretical framework of the FFM has been devised, research on personality development tends to focus on isolated traits observed in childhood and adolescence. Consequently, research on personality development in early life is somewhat fragmented (Halverson Jr et al., 1994),

The term temperament is used in the literature to describe individual differences in childhood and has similarities to what in adulthood is termed personality. Temperament naturally gets more complex as an individual matures. Caregiver temperament questionnaires, laboratory based experimental research, and home

observational assessments provide evidence that a number of personality traits can be observed and measured reliably in childhood (Caspi and Shiner, 2006). Children as young as toddlers differ in these observable and reliably measurable traits. The higher order traits of surgency (an eager approach to potentially pleasurable activities), negative affectivity (the tendency towards negative emotion), and effortful control (the burgeoning tendency to exercise restraint and self-regulation) appear to map to the higher order personality traits of Extraversion, Neuroticism, and Conscientiousness seen in adults.

Research utilising FFM trait taxonomy has given some insight into how children's personalities vary and mature as they develop into adults (Caspi and Shiner, 2006). Much of this work substantiates assertions that personality is relatively stable over time and early childhood tendencies have repeatedly demonstrated predictive validity for later temperament (Caspi et al., 2003, Rothbart et al., 2001). In what follows each of the five higher order traits of the FFM will be considered in turn and key research on their nature and development will be reviewed.

1.6.1 Extraversion

Extraversion refers to the predisposition to seek out activity and the company of others. Individuals high in this trait are frequently described as assertive, outspoken, and energetic, rather than reserved and shy (McCrae and Costa, 1987).

A 23-year longitudinal study by Caspi et al. (2003) found highly confident and friendly 3-year-olds exhibited high levels of Extraversion as adults with the opposite being true for those children initially seen to be socially reticent. Three related models have been advanced to explain the basis of Extraversion. Firstly, Extraversion can be considered to be a predisposition to experiencing positive emotions (DeNeve and Cooper, 1998).

A meta-analysis by Lucas and Fujita (2000) found a correlation of 0.37 between extraversion and the simultaneous experience of positive affect. This may be explained by the fact that extraverted individuals have a greater tendency to take part in activities which promote positive emotions such as spending time with friends (Caspi and Shiner, 2006). In addition, extraverted individuals appear to experience more positive emotions even in isolation, suggesting an intrinsic predisposition to positive affect (Lucas and Baird, 2004). It has also been suggested that extraverted individuals have a more sensitive, biologically based behavioural system termed the behavioural activation system (BAS). This is a neurobiological system which responds to environmental stimuli which suggest potential reward (Gray, 1990). Extraverted individuals may have a more sensitive BAS and so may be more likely to seek out experiences which promote positive emotions and enjoy such experiences to a greater degree (Caspi and Shiner, 2006, McCrae and Costa Jr, 2008). A third model of Extraversion suggests this trait may reflect a greater tendency to attract and enjoy social attention, with this attention having the potential to provide reward and opportunities for the individual (Ashton et al., 2002). From a neurostructural perspective, there is evidence to suggest Extraversion may be a manifestation of differences in the dopamine system which is involved in the regulation of incentive motivation and the behavioural approach to reward. (DeYoung, 2010).

1.6.2 Neuroticism

This trait describes the tendency to experience negative affect such as anxiety, depression and anger. Individuals high in this trait are thought to be tense, anxious, or feel substantial self-doubt (McCrae and Costa, 1987). The inverse of this trait is Emotional Stability which sometimes takes the place of Neuroticism in certain iterations of the FFM but refers to the inverse of the same psychological variable.

Research based on the FFM has found children to vary in levels of Neuroticism (Caspi and Shiner, 2006). Children high in this trait are described as vulnerable, tense, and anxious whereas those lower in neuroticism are characterised as having adaptability and stability. Neuroticism may reflect a tendency to view the world as threatening, problematic and distressing (McCrae and Costa Jr, 2008), and research has found neurotic individuals to show greater levels of dissatisfaction with major aspects of their lives (Heller et al., 2004).

Individuals high in Neuroticism show a greater cognitive bias towards information consistent with their personal fears, and have a tendency to ruminate on past negative experiences (Mineka et al., 2003). These biases may be the result of the improper functioning of attention. Those high in neuroticism may suffer from a tendency to devote an inappropriate degree of attention to negative information. A focus on negative information may itself impair the proper allocation of attention to experiences less likely to promote negative affect.

Neuroticism is linked to self-report of more negative daily experiences in adults, and research suggests this is due to stronger negative reactions to day-to-day problems combined with difficulties in emotional and behavioural regulation (Ozer and Benet-Martinez, 2006). Individuals high in trait neuroticism are more likely to show responses characterised by ineffective coping strategies such as avoidance and interpersonal confrontation (Gunthert et al., 1999, Gable et al., 2000). This may further predispose to greater negative affect.

In contrast with Extraversion, differences in Neuroticism may reflect variability in what Gray termed the Behavioural Inhibition System (Gray, 1990). This is thought to inhibit behaviour when an individual is presented with novelty or potential punishment

causing more neurotic individuals to withdraw in situations characterised by both incentives and threats. Despite this greater desire to avoid threatening scenarios, neurotic individuals actually appear to experience a greater number of objectively negative life events (Lahey, 2009, Magnus et al., 1993).

1.6.3 Conscientiousness

This trait refers to differences in self-control and how this is applied in the completion of tasks and meeting of standards. Individuals high in this trait will invest greater time and effort in completing work, upholding commitments, and maintaining order (McCrae and Costa Jr, 2008).

Studies investigating the development of Conscientiousness find such children to be described as persistent, orderly, and neat (Caspi and Shiner, 2006). Conscientiousness is thought to be highly related to an early childhood temperament trait labelled effortful-control (Rothbart et al., 2001), and this, as an antecedent of Conscientiousness, can be observed in even pre-school-age children (Caspi et al., 2003).

The value of this trait in the workplace is self-evident and research finds conscientious individuals to score higher on markers of academic achievement and professional success (Ozer and Benet-Martinez, 2006, Roberts et al., 2007). The nature of the occupation may be important as Wilmot and Ones (2019) found this trait to predict performance in high-complexity as opposed to low or moderate-complexity occupations.

1.6.4 Agreeableness

Agreeableness refers to a disposition towards getting along with others. Individuals high in this trait are described as kind, appreciative and altruistic, whereas those on the lower pole are considered sceptical, competitive, and antagonistic (McCrae and Costa, 1987).

The development of Agreeableness, or those behaviours most consistently correlated with this trait, manifests in early childhood. Longitudinal research found teacher and peer reports of aggression, compliance, and self-control at age 8 distinguished high-agreeableness from low-agreeableness adults years later, at age 25 (Laursen et al., 2002)

Highly agreeable individuals tend to co-operate with and show concern for others at the expense of their own interests. Those high in this trait will demonstrate prosocial behaviour whereas those lower in agreeableness may show a disregard for others (McCrae and Costa Jr, 2008). There is evidence to suggest agreeable individuals experience greater negative affect from interpersonal conflict and so strive to maintain peaceable relationships (Caspi and Shiner, 2006). This does not necessarily imply a submissive predisposition, but rather an ability to generate fewer conflicts and resolve them more effectively (Jensen-Campbell et al., 2003).

1.6.5 Openness to Experience

Openness refers to the richness and complexity of an individual's intellectual and emotional life. Individuals high in Openness tend to be more imaginative and artistic, having a broader range of interests relative to those who are more conventional or 'down-to-earth' (Connelly et al., 2014, McCrae and Sutin, 2009)

This trait is perhaps the most difficult to define and has provoked the greatest amount of debate over its precise nature. High Openness individuals tend to seek out novel and intellectually enriching experiences and have a tendency to reflect and devote greater thought to the ideas they encounter (McCrae and Costa, 1997, McCrae and Sutin, 2009). There is some overlap of this trait with cognitive ability/intelligence, however the two are on the whole distinct entities (DeYoung et al., 2014, McCrae and Sutin, 2009).

Despite the developmental antecedents of Openness being unknown, this trait can be in some part measured in children by age 6 or 7, suggesting that, much like the other five factors, Openness sees development in early childhood through a complex interaction of genetics and the environment and continues to mature across the lifespan (Caspi and Shiner, 2006).

1.7 Psychometric Personality Tests

Psychometrics is the field of psychology concerned with testing and measurement. There are numerous psychometric tests available and their methodological validity and reliability varies (Robins et al., 2009, John et al., 2008a). There is presently little consensus on how best to measure personality traits as they are presented in the FFM (Goldberg, 1999). The most validated assessments, such as the Revised NEO Personality Inventory (NEO PI-R) and NEO-Five Factor Inventory (NEO-FFI) (Costa Jr and McCrae, 1992), are proprietary, copyrighted and pay-per-use thereby limiting refinement by other researchers. However, Goldberg et al. (2006) developed the International Personality Item Pool (IPIP) which is a collection of open access personality items which are used to construct psychometric inventories. From the IPIP, several inventories have been developed as proxies for the proprietary ones. These

open access inventories have demonstrated comparable levels of reliability and validity indicating their suitability for use in research (Maples-Keller et al., 2019, John et al., 2008a).

Criticisms of psychometric research centre on its frequent use of self-report questionnaires, its use of undergraduate samples, and its correlational nature (Paulhus and Vazire, 2007). Self-report measures may be problematic as biases, for example social desirability bias, may limit their accuracy, and research has shown people frequently lack self-awareness, insight (Kruger and Dunning, 1999), and may even suffer from self-deception (Maltby et al., 2010). Despite these shortcomings, psychometric personality measures have consistently demonstrated the ability to predict multiple consequential outcomes (Ozer and Benet-Martinez, 2006). Furthermore, individuals have the most direct experience of their unique personalities and so may be best placed to report on them. Finally, the most used self-report questionnaires have demonstrated good validity and reliability across a number of studies, with self and peer reports demonstrating acceptable congruence (Soto et al., 2008, Paulhus and Vazire, 2007)

1.8 Personality and Dentistry

1.8.1 The Dental Team

The dental workforce in the UK is comprised of a number of different professional groups with varying scopes of practice and training backgrounds (General_Dental_Council, 2013a). The delivery of dentistry requires these professionals to frequently work together both in-person and via pathways of referral and inter-disciplinary working. This present study focuses on dental nurses, general dental practitioners (GDPs), orthodontists and oral and maxillofacial (OMF) surgeons. These four professional groups frequently liaise and work together in the management of orthodontic patients. Not all of these groups may be involved in the care of every orthodontic patient, but the amount of close-working and communication between them justifies investigation into how their personalities may differ. In what follows, the training and roles of each group will be considered, and their demographic characteristics will be explored.

1.8.2 General Dental Practitioners (GDPs)

The beginning of professional dentistry was perhaps designated by the publication of the first dental textbook; Pierre Fauchard's *Le Chirurgien Dentiste* in 1728 (Lynch et al., 2006). Legal controls and regulation of the profession are a recent phenomenon, and only since the Dentists' Act 1878, and the Dentists' Register being established in 1879, have the titles Dentist or Dental Surgeon been restricted to qualified and registered professionals. Unregistered practitioners still outnumbered qualified dentists until revisions to the Dentist Act in 1921 made the practice of dentistry by unregistered individuals illegal (Sell, 2005).

Today, dental training follows a well-established and structured pathway. Prospective dentists are required to complete a programme of higher education at a recognised dental school. This is in the form of an undergraduate degree usually spanning five years and aiming to deliver on the learning outcomes outlined by the regulatory body for dentistry in the UK, the General Dental Council (GDC) (General_Dental_Council, 2015). However, this period of training may be lessened for postgraduate students or those who have previously completed a medical degree and wish to pursue a career in oral and maxillofacial surgery (OMFS).

Following graduation, newly-qualified dentists must complete a year of dental foundation training to work in National Health Service (NHS) primary care (COPDEND, 2015). Aside from mandatory Continuous Professional Development (CPD), there is no further formal training mandated for a dentist who wishes to practice as a GDP unless they wish to develop skills they do not already possess.

The term GDP is often used to draw a distinction between dentists who perform the majority of dental procedures and those specialist dentists who focus or limit their practice to a specific domain of dentistry. Becoming a specialist entails either completing one of the specialty training programmes recruited to via a national process, or demonstrating the relevant competencies through other means. Both approaches require successful completion of an examination process provided by one of the Royal Colleges of Surgeons (General_Dental_Council, 2019).

GDPs will see many of their patients on a regular basis for routine dental examinations and treatment. They play a pivotal role in monitoring for conditions which may require input from other specialities, such as orthodontics or OMF surgeons. Bidirectional communication between the GDP and such specialists is essential in ensuring

adequate continuity of care and facilitating expedient and properly sequenced treatment.

The pivotal role of the GDP is perhaps best illustrated through the example of a patient requiring treatment to correct a severe malocclusion (deviation from normal dental and jaw relationships). Such a patient may present to the GDP in the first instance. A referral would then be made to the orthodontist who would assess the patient and devise a treatment plan. If dental extractions are required, the patient may be referred back to the GDP for these to be completed. If the patient requires both orthodontic treatment and surgery to correct the malocclusion, there will be three-way communication between GDP, orthodontist, and surgeon at key stages of the patient's journey. Throughout treatment, and upon its completion, the GDP regularly sees the patient to monitor dental health and provide any necessary treatment.

1.8.3 Dental Nurses

The development of dental nursing as a profession has run in parallel to that of dentistry. The first dental nurses were informal assistants to the earliest dental practitioners, though neither may have had any formal training. The first school of dental nursing was established in New Zealand in 1921, but true recognition of the role in the UK likely coincided with the formation of the British Association of Dental Nurses in the 1940s and the first dental nursing examinations, which took place in 1943 (Society_of_British_Dental_Nurses, 2020).

In contrast with dentists, registration with the regulatory body was not mandated until relatively recently. Formal training was not necessary until a report by the Dental Auxiliaries Review Group of the GDC recommended all dental auxiliaries, including dental nurses, obtained recognised training and registration and compulsory

registration commenced in 2006 (Society_of_British_Dental_Nurses, 2020, McGlashan et al., 2004). A regional survey of 254 dental nurses, conducted in 2002, found 60% to have no formal qualifications, highlighting the dramatic change in the approach to training and regulation of these professionals in the last two decades (John et al., 2002).

Prior to the requirement of formal training, those who wished to obtain qualifications could do so through the National Examination Board for Dental Nurses (NEBDN). This was superseded by the National Vocational Qualification (NVQ) in Oral Health Care Dental Nursing in 2000 which is thought to have aligned assessment to a nationally recognised standard (John et al., 2002). Presently, the landscape of available training is varied with foundation degrees, higher education certificates, and undergraduate degrees all being offered. However, work-based learning remains the most commonly opted for approach. (Society_of_British_Dental_Nurses, 2020)

Dental nurses invariably work alongside other dental professionals and assist the clinician in providing patient care. They do this in part through ensuring compliance with cross-infection control procedures, preparing and manipulating dental materials, and assisting in the maintenance of contemporaneous patient records (General_Dental_Council, 2013a). It is difficult to conceive of a procedure which is not delivered more efficiently through such teamworking.

This is evidenced by the ratio of dentists to dental nurses registered with the GDC, showing there to be in fact more dental nurses than there are dentists (General_Dental_Council, 2020). There is good reason to assume the personality of dental nurses will be distinct from that of the other professionals discussed here. Dental nurses tend to be female, and as has been discussed, the training necessary

for their role may mean, on average, fewer years spent in education. There may also be mean differences in age as one cannot qualify as a dentist until completion of five years of undergraduate study, orthodontists undertake at least a three year period of formal training in addition to this, and OMF surgeons must complete two undergraduate degrees as well as the specialty training itself. Consequently, a dental nurse may be qualified many years before the other three professionals. In addition, the role itself is rather distinct and so may be suited to a particular personality profile.

1.8.4 Orthodontists

Orthodontics is the specialty of dentistry concerned with the diagnosis, prevention and treatment of irregularities of the teeth, occlusion, and facial growth. The first documented evidence of attempts to correct crowded or protruding teeth dates back 3000 years (Weinberger, 1934). The aforementioned Pierre Fauchard's 1728 opus *Le Chirurgien Dentiste* documented the early appliances used to correct malocclusion, such as the *bandeau*, the principles of which are applied in treatment approaches seen even today (Wahl, 2005a). In the centuries that followed, pioneering individuals developed the art and science of orthodontics, with the American orthodontist Edward H. Angle (1855–1930) perhaps doing more than any other to delineate this branch of dentistry as its own specialty, distinct from general practice (Wahl, 2005b).

Presently, UK orthodontists must first complete the same undergraduate training as their GDP colleagues. Following this, they must complete at least a year of “foundation” training, followed by “core” training, which entails gaining a broad base of experience and knowledge in general dental practice, the dental specialties, and OMF surgery (SAC_Othodontics, 2010). Experience in the latter is particularly valued given the close working relationship between the two specialties. Recruitment into specialty

training in orthodontics is by way of a competitive selection process administered nationally. In order to perform well candidates must possess a range of academic and clinical competencies stipulated in the person specification published by the UK Committee of Postgraduate Dental Deans and Directors (COPDEND) (COPDEND, 2021)

The specialty training programme spans three years and, upon nearing its completion, trainees must sit the Membership in Orthodontics (MOrth) examination through one of the Royal Colleges of Surgeons. Success in this exam confers the protected title of 'Specialist Orthodontist' and is indicative of a clinician competent in assessing, diagnosing, and treating the range of malocclusions one would expect to encounter in orthodontic primary care (SAC_Othodontics, 2010). These specialists may then opt to complete a further two years of training and sit the Intercollegiate Specialty Fellowship Exam (ISFE) which permits appointment as a consultant in secondary care and provides evidence of competence in managing patients with more severe craniofacial abnormality, as well as a greater knowledge of leadership and management in an NHS context (SAC_Othodontics, 2012).

The fact that some dentists chose to undertake further orthodontic specialty training whilst others do not, or indeed chose other specialties, could imply, amongst other differences, variations in personality. For example, this further period of study may appeal to those higher in Conscientiousness as there is evidence to suggest this correlates with years spent in education (Costa et al., 2000, Roberts et al., 2007). Knowledge of such differences could prove valuable to those considering applying for orthodontic specialty training and may improve their appraisal of whether they are likely to be satisfied in such a role (Judge et al., 2002b).

1.8.5 Oral & Maxillofacial (OMF) Surgeons

OMF surgeons specialise in the diagnosis and treatment of diseases affecting the mouth, jaws, face, and neck. Although OMFS has its origins in dentistry, it is now considered one of the 10 UK surgical specialties. OMF surgeons are required to register with the General Medical Council (GMC) but need not maintain registration with the GDC as long as they do not practice dentistry.

Training in OMFS in the UK is unique in that it requires the completion of two separate undergraduate degrees, one in medicine and another in dentistry. This stipulation has been in place since 1984 (Mannion and Kanatas, 2020). Surgeons differ in the order in which they complete these with dentistry first trainees historically making up the majority of registrars and consultants. Recent years have, however, seen a greater number of individuals completing their medical training first before embarking on a dental degree with a view to train in OMFS (Magennis et al., 2020). Once trainees have completed both their undergraduate dental and medical training, along with some basic training in surgery and dentistry, they apply for specialty training posts in OMFS which are filled through a process of competitive national recruitment. Specialty training itself usually lasts a period of five years and trainees sit the Fellowship of the Royal College of Surgeons (FRCS) OMFS “exit” exam towards the end of their training. On completion of training, some OMF surgeons may have spent a total of 19 years in education (General_Medical_Council, 2011).

The markedly different training pathway suggests that particular personality types may be attracted to this unique profession. Considering healthcare more broadly, there is some evidence to suggest a difference in personality between surgeons and physicians (Stienen et al., 2018). In their survey of dental undergraduate students,

Belsi et al. (2011) found students who had already completed a medical degree, and were studying dentistry in order to pursue a career in OMFS, had significant differences in personality relative to dental nursing and dental therapy students. It seems pragmatic to assume such differences may be seen in qualified professionals and this present investigation aims to test such assumptions. Finally, the working environment of OMF surgeons is most drastically different from the other three professions discussed. As surgeons principally work in hospital settings, and more specifically theatre settings, where a greater quantity and different nature of interpersonal interactions can be anticipated, one may hypothesise that they may have higher mean levels of traits such as Extraversion.

1.9 Personality and the Dental Team

Personality strongly influences how individuals communicate with one another and how they present themselves. Self-presentation specifically refers to tactics designed to achieve specific goals from interpersonal interaction (Paulhus and Trapnell, 2008). Personality and communication style are interlinked (Bakker-Pieper and de Vries, 2013), and differences in personality help to explain variability in effective communication and leadership (Judge et al., 2002a).

Dental professionals invariably work in teams and communication is central to effective teamwork. The GDC stipulates that dental professionals communicate effectively with patients and each other (General_Dental_Council, 2013b). Given how personality influences the manner in which individuals communicate and present themselves, there may be scope to improve communication between professionals if there is a greater appreciation of individual differences.

1.10 Personality and Occupational Choice

Many theorists have attempted to explain why certain individuals pick specific careers over others. Many of the proposed theories allude to the need for a “fit” between the characteristics of an occupation and the individual considering it. Meta-analytic work investigating personality-career fit has evidenced how a mismatch between the two may act as a catalyst for the individual to change career (Tsabari et al., 2005). Partly as a result of this attritive effect, occupational theory and empirical research suggest a high degree of homogeneity within occupational groups. This implies that individuals within an occupation will more close resemble each other relative to individuals in a different occupation (Holland, 1999, King et al., 2017).

A highly influential theory of occupational choice was proposed by Holland (1959). He suggested that occupational choice was one aspect of personality and that descriptions of a person’s occupational interests provided insight into the personality of that individual. His contention was that members of a particular occupation would share personality characteristics due to a mutual environment and shared experiences. Occupational satisfaction, stability, and success would partly be a function of the congruence between personality and occupational environment (Holland, 1997).

Holland developed six basic personality types to describe both individuals and the prevailing nature of different work environments: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (commonly abbreviated with the acronym RIASEC) (Holland, 1997). Each type is characterised by a combination of interests, preferred activities, values, and abilities. An individual may be given a ‘Holland code’ upon completion of assessments aimed at identifying their preferences; this is the first

three letters of the RIASEC types the person most resembles. Realistic types enjoy working with their hands, or with tools and machinery, and work in sectors like agriculture or mechanical engineering. Investigative types enjoy analytical work and information processing and work in the fields of science, mathematics, and economics. Artistic types are drawn to creative occupations such as graphic design or film. Social types are thought to be keen to work in occupations with relatively higher amounts of social interaction such as nursing or counselling. Enterprising types are predisposed to persuade and lead. They tend to be found in positions in banking, finance, and insurance. Finally, conventional types are detail orientated and favour high levels of structure and organisation. They prefer occupations in accounting, actuarial science, and technical writing (Astin and Holland, 1961). There is empirical support for the existence of Holland's types and the tenets of his theory appear to hold across genders, ethnicities, and differing ages (Nauta, 2010).

Holland's typology pervades modern career counselling and he developed a number of instruments used to assess both people and work environments with respect to the RIASEC types (Nauta, 2010). Holland spent much of the latter part of his career testing the hypotheses of his theory and attempting to develop a body of empirical evidence to support it, whilst also testing the psychometric properties of the instruments he developed (Holland, 1999). His consistent assertion was that inventories aiming to measure vocational interests were simultaneously measuring personality. Once the FFM of personality began to develop a body of empirical support in the literature, the relationship between RIASEC types and the Big Five personality dimensions was studied extensively (Barrick et al., 2003). Relationships are consistently seen between Extraversion and both Social and Enterprising interests, Openness and both Artistic and Investigative interests, and Agreeableness and Social interests, thereby

supporting Holland's assertion on the relationship between vocational interests and personality.

Meta-analyses have demonstrated that greater person-work environment congruence, with respect to the RIASEC types and also the FFM personality dimensions, is associated with greater job satisfaction. However, the effect sizes appear to be small. Tsabari et al. (2005) found a mean congruence-satisfaction correlation of .17. This should be viewed in the context of effect sizes in psychology literature in general which are of a comparable size (Meyer et al., 2001, Fraley and Marks, 2007). That said, it is evident that the fit of one's interests, and by extension their personality, to their role cannot wholly determine their job satisfaction. There is value however in appreciating what the congruence between the two will likely be as satisfaction in one's working life is at least partly dependent upon it (Nauta, 2010).

Holland's theory takes an inferential approach to considering the relationship between personality and job satisfaction as his RIASEC types are representations of an individual's interests, values and abilities which will be influenced by their personality but not entirely dependent upon it. Researchers have also attempted to investigate the relationship between more direct measures of personality and job satisfaction through the lens of the FFM (Judge et al., 2002b, Judge and Larsen, 2001).

A meta-analysis by Judge et al. (2002b) found Neuroticism to be the strongest correlate of job satisfaction with an estimated correlation of -.29 across the studies included in the analysis. Conscientiousness had a correlation of .26 and Extraversion .25 on the same measure. Their findings confirm the intuitive sentiment that those low in Neuroticism and high in Extraversion are likely to be happier in their jobs and in life in general. Although this has been a consistent finding in the literature, a recent meta-

analytic work by Anglim et al. (2020) has again confirmed this to be the case when reviewing 462 studies representing a total of 334,567 participants.

Given the evident associations between personality and job satisfaction, it may be useful for prospective applicants to the four professions being considered here to be aware of what the average personality profile of incumbents in these roles is. They could then draw comparisons and deduce whether there would be a good fit. Schneider's attraction-election-attrition model describes how perceptions of fit between a person and a prospective occupational environment motivates them to select into it (Schneider, 1987). If the occupation is a misfit, they are more likely to leave. Those individuals that remain in a particular occupation would therefore demonstrate similar attributes, including similar personalities (Barrick et al., 2003). Upon reviewing the results of our investigation, if a person feels their personality is likely to mesh well with that of their prospective colleagues in one of the four occupations they may be more inclined to pursue that career.

Finally, recruiters or educational institutions may also be able to appraise how the traits of applicants compare with those of incumbents and this could be an additional criterion used to identify those candidates likely to be successful in a given role (Barrick and Mount, 1991).

1.11 Selecting the Psychometric Test

Research looking at personality amongst health professionals has used a variety of psychometric tests. These in turn have reflected different theoretical models of personality. Tests such as the MBTI, based on work by Jung, purport to sort respondents into categories which describe the broad nature of their personalities (Myers et al., 1998). The MBTI, although tremendously popular, has demonstrated poor reliability and a vulnerability to purposive faking from respondents (Zemke, 1992, Gardner and Martinko, 1996). Empirical evidence for the validity of tests based on such psychoanalytic work is limited and their use has been criticised (Barenbaum and Winter, 2008)

Psychometric tests based on the FFM have a greater abundance of literature supporting their use and methodological validity (John et al., 2008a, McCrae and Costa Jr, 2008, Maltby et al., 2010). Furthermore, their theoretical basis appears more robust as a number of studies have confirmed the prevailing strength of the FFM in describing personality across highly distinct populations (McCrae and Terracciano, 2005b).

Researchers looking at personality amongst health professionals have occasionally employed questionnaires utilising the five-factor model (Epstein and Krasner, 2013, Hojat et al., 1999, Duberstein et al., 2008). Research on qualified dental professionals using the FFM is scant. However, Belsi et al. (2011) used a Big Five personality inventory to investigate personality amongst dental undergraduates and trainee dental care professionals. Similar work was performed by Chamberlain et al. (2005) who used the NEO-PI-R, a FFM inventory, to compare personality between dental students and qualified dentists.

Despite this precedent and successful use of the NEO-PI-R its proprietary nature and associated cost make its ready application challenging.

The International Personality Item Pool (IPIP) is an online collection of personality questionnaire items which have been devised by multiple researchers (Goldberg, 1999, Goldberg et al., 2006). These items have then been placed into questionnaires which correlate strongly with reliable and validated inventories such as the NEO-PI-R as they both aim to measure personality as described by the FFM (Goldberg, 1999, Johnson, 2014, Maples et al., 2014). IPIP items and questionnaires are in the public domain and have been used in many publications to date (Goldberg et al., 2006). Furthermore, a recent meta-analysis found certain free-to-use inventories to be more efficient in measuring personality traits, through having a greater reliability, than their proprietary alternatives (Hamby et al., 2016).

In selecting the most appropriate psychometric test one must also consider respondent fatigue. The NEO PI-R has a briefer version, the NEO-FFI (Costa Jr and McCrae, 1992), which consists of 60 items from the NEO PI-R. This measure, however, is also copyrighted and pay-per-use. Consequently, it seems pragmatic to select an inventory which will provide the right balance between richness of data and minimisation of respondent fatigue. It should also have adequate bandwidth to capture the five domains and be free-to-use. IPIP inventories with 60, 120, or 300 items are available and all show strong reliability and convergence with the NEO-PI-R (Maples et al., 2014, Maples-Keller et al., 2019, Johnson, 2014, Goldberg et al., 2006). Oliver John's Big Five Inventory (BFI) is briefer still (Benet-Martínez and John, 1998, John et al., 2008a), being composed of only 44 items and a recent meta-analysis found it to

have good reliability and validity compared to other free to use psychometric tests (Hamby et al., 2016).

It was determined then for this study that the BFI satisfies the criteria for a valid psychometric test providing adequate richness of data and permitting analysis of the Big Five and more narrow facet level traits. In addition it is relatively brief, being 44 items long, which has the potential to minimise respondent fatigue and maximise survey completion.

1.12 Personality in Qualified Dentists

Research has found significant differences in personality between medical specialties (Borges and Savickas, 2002, Hojat et al., 1999, Hojat and Zuckerman, 2008), however such research in dentistry is comparatively scant and that which has been published uses inventories based on theory less empirically robust than the FFM.

A search of the literature was conducted to identify work investigating the personality of qualified dental professionals. Of the 56 non-duplicate results returned, an abstract review revealed 13 of relevance which were then read in full. None of these investigated personality differences between groups of **qualified** dental professionals and the majority used the MBTI which has been criticised for a lack of validity (Stein and Swan, 2019). Only one study, by Mallinger et al. (1978), used a psychometric test which is consistent with the FFM. This found personality to predict aspects of professional success in dentistry but did not compare across professional groups.

1.13 Personality in Medical Professionals

In light of the paucity of research similar to the present investigation, the search was expanded. Firstly, to identify those studies looking at personality differences between medical professionals or students, and secondly to identify studies investigating personality in dental students.

Research investigating personality differences in physicians and surgeons most frequently takes one of two approaches. Either qualified professionals are surveyed once they have been inducted into their specialty of choice, or medical students are asked to state their preferred specialty before a place on the relevant training programme is secured. The latter approach is problematic in that there is no guarantee that a student will attain a place in their preferred specialty or that their preferences will remain consistent up until the point they complete training in a specialty. However, there appears to have been far more investigations into personality differences as they pertain to medical specialty choice amongst medical students than any differences between qualified medical professionals. For this reason, the literature search aimed to identify studies concerning both qualified professionals and medical students.

The search was limited to publications in the English language. 158 results were returned. First the titles were reviewed, followed by the abstracts, to determine the relevance of the methodology to our investigation in dental professionals.

One review of the literature was identified (Borges and Savickas, 2002). The authors acknowledged the variety of personality inventories used in studies in this area and attempted to relate them to the integrative framework of the FFM. They note that the

nature of the specialties in medicine (and surgery) can be dramatically different and so consequently, and in accordance with Holland's (1997) assertions, one would expect the personality of those in different specialties to vary. The heterogeneity of personality inventories used in the studies reviewed did not permit a meta-analysis, but the authors attempted to relate the findings of each study to the FFM.

They concluded that no specialty could be characterised by a unique pattern of Big Five personality factors, and that there was a relative homogeneity in personality across specialties. Most appeared to require a similar pattern of personality characteristics with sufficient tolerance to permit a wide variety of individuals to work effectively in that specialty. There was more variation in personality traits within specialties than between them. Any inconsistencies in findings between different studies was thought to be the result measurement error and differing approaches to sampling. One interesting finding related to how the empirical research frequently, albeit loosely, corroborated the anecdotal stereotypes of certain specialties described in much earlier work.

The authors cited the two component model of Borman and Motowidlo (1997) which differentiates between tasks an individual completes as part of their role and the social and organizational context in which those tasks are undertaken. They argue that personality may relate more to contextual performance, e.g. how a person relates to others in their work environment, than to the technical procedures which characterise a given specialty. To illustrate their point further, two orthopaedic surgeons may perform exactly the same procedures day-to-day, but one may elect to work in a tertiary centre with greater multi-disciplinary working and a larger teaching commitment, perhaps reflecting greater trait Extraversion. Therefore, the suggestion

that all orthopaedic surgeons may have a particular personality profile may be overly reductionist.

The conclusions of this review should be treated with some caution as not a single study measured the personality of participants using an inventory based directly on the FFM. Borges and Savickas (2002) attempted to relate the results from the studies they reviewed to the FFM, but this post hoc attempt to fit existing data to a different model than the one on which an inventory was originally conceived reduces confidence in their conclusions. Many of the studies reviewed used the MBTI and are therefore negatively affected by its limited validity and reliability (Stein and Swan, 2019). The authors' most emphatic recommendation was that such research in the future should use an inventory based explicitly on the FFM permitting contextualisation into the wider personality literature.

Since the publication of the above review several studies have either used a measure of personality based on the FFM or have attempted to relate the results of other inventories to the FFM framework. Borges and Gibson (2005) conducted a study investigating personality differences between 'person-orientated' and 'technique-orientated' physicians. The former were characterised as directing care at the entire patient whereas the latter tended to focus on specific areas of the body (psychiatrists versus orthopaedic surgeons illustrates this distinction). This taxonomy had been used in previous research in the area and personality differences were found between professionals when grouped in this manner. The psychometric inventory used was the Personality Research Form (PRF); an inventory that does not directly relate to the FFM, however the researchers did convert the PRF traits to the Big Five. Their sample consisted of 244 physicians and higher levels of Agreeableness were associated with

person-orientated rather than technique orientated physicians. In addition, specific PRF traits and gender were also found to differentiate between the two groups of physicians. The study was limited by the ability of the PRF to measure the Big Five, and although the PRF itself seemed useful in identifying personality differences between broadly categorised specialties, a non FFM inventory again limits integration with the wider personality literature.

Hoffman et al. (2010) used the FFM to investigate personality differences between surgical residents (what would be termed registrars UK parlance), medical residents, medical students, and population norms. Their sample consisted of 274 qualified professionals and 207 medical students. The personality inventory used was the BFI – a direct measure of the Big Five. The authors also asked participants to complete a truncated version of the Balanced Inventory of Desirable Responding (BIDR). This is a measure of socially desirable responding which the authors used to control for intentional faking on the self-report personality inventory. Their statistical analysis and reporting focused on how surgical residents differed from the other groups after controlling for socially desirable responding.

No significant differences between groups were seen in BIDR score. Compared to normative data, surgical residents had higher scores for Conscientiousness, Extraversion, and Emotional Stability (the inverse of Neuroticism). However, they had lower scores for Openness. The surgical residents also demonstrated higher Conscientiousness relative to medical students and paediatric residents, although all groups had Conscientiousness scores higher than population norms.

The strength of this study lies in its attempt to quantify and control for socially desirable responding. In addition, the comparison with population norms illustrates that,

although there are differences between subgroups of the medical profession, the broader category of medical students and professionals demonstrates on average a different personality profile to the general population; most significantly, higher levels of Conscientiousness.

No data on potentially confounding demographic variables such as age and gender was collected and so it was not possible to account for these in the analysis. Differences between surgical residents and the other groups may be explained by a markedly different age and gender breakdown. The authors conducted a further statistical analysis to address this by using pre-existing data on the gender makeup of the groups invited to participate and gender-specific norms from previous research. They concluded that after accounting for gender in this manner, the results remained largely unchanged, and that gender was unlikely to have played a significant role in their findings. This cannot be known for certain, and the number assumptions they make to account for the influence of gender without having directly recorded it, limits the confidence one can have in this assertion.

A relatively recent study by Woods et al. (2016) looked at personality amongst junior doctors in the NHS. They investigated associations between the Big Five and medical specialties categorised using the RIASEC model (Holland, 1997). The RIASEC model has six categories and allows for specialties to be profiled with a greater fidelity compared to research such as that by Borges and Gibson (2005) which used the person-orientated or technique-orientated specialty dichotomous distinction. In keeping with the recommendations of the review by Borges and Savickas (2002), personality was measured using a FFM inventory – the NEO PI-R. This is perhaps the

most widely-used FFM inventory with ample literature confirming its validity and reliability (McCrae, 2002).

The 199 participants were all undertaking the postgraduate specialty training that follows foundation training of junior doctors in the UK. In other words, they had selected their specialty of choice and were completing the necessary training to eventually qualify in it. The different medical specialties were assigned RIASEC scores using a validated online tool. The researchers entered the specialty name into a database which provided them with scores that described how highly that occupation rated on each one of the six RIASEC dimensions, thereby categorising the specialty to the extent that it is Realistic, Investigative, Artistic etc. These ratings came from subject experts, however previous research had confirmed the validity of these ratings and their suitability for use in research.

Regression analyses revealed greater Agreeableness to be associated with working in specialties with a larger Social element, and Neuroticism was negatively associated with working in more Realistic and Enterprising specialties, but positively associated with more Artistic specialties. The authors surmised that individuals with higher levels of trait Agreeableness would select into specialties that require more social interaction, such as general practice, reflecting the prosocial nature of this trait. They suggest higher Neuroticism may influence an individual to avoid those specialties characterised as Realistic. In the RIASEC taxonomy these occupations are characterised by working with one's hands or with tools e.g. surgery or obstetrics. In these specialties there is ready attribution between the actions of the doctor and immediate negative consequences e.g. the life-changing impacts of a surgical error.

Those high in trait Neuroticism may perceive such working pressures as more threatening and avoid them.

The study looked purely at the associations between the Big Five and medical specialty as characterised by the RIASEC model. Other variables which could influence specialty choice, and by extension describe the differences between individuals in different specialties, were not considered in the analysis. The R^2 of the regression models did not exceed .08, demonstrating that no more than 8% of variability in RIASEC score could be explained by personality alone. Age, gender and other demographic variables could influence specialty choice and the influence of these relative to personality cannot be ascertained from this investigation. Furthermore, factors such as geographical location and availability of training posts influence specialty choice and the extent to which they moderated the effect of personality cannot be determined. Nonetheless, this work adds to the body of evidence showing differences in personality between medical specialties, and suggests that when specialties within a profession vary substantially differences in the Big Five traits between specialties may be anticipated. The findings related to Neuroticism and its negative association with working in surgical specialties, leads us to hypothesise that the OMF surgeons in our sample may have lower levels of trait Neuroticism.

1.14 Personality in Dental Students

A further search of the literature was conducted to identify research on the personality of dental students. Although our research aims to investigate the personality of qualified professionals, work on students may elucidate relevant methodological considerations.

Of the 91 results returned, four were relevant by virtue of their methodology i.e. use of psychometric inventories based on the FFM.

In a Canadian sample, Smithers et al. (2004) evaluated the validity of the FFM in predicting performance in both the academic and clinical components of dental training. They also examined whether the addition of a personality measure into the assessment of dental school applicants increased the validity of performance prediction achieved by interview and aptitude tests alone. Their sample comprised of 145 dental students in the first three years of their training at two Canadian dental schools, 46% were male and 54% female. The inventory used was the NEO PI-R. (McCrae, 2002).

With regards to the five broad personality domains, Openness showed a negative correlation with performance in the second and third years of dental training ($r = -.15$ to $-.40$ depending on the year) i.e. the less imaginative and intellectually curious students scored better on measures of academic and clinical performance. The other four factors did not predict academic or clinical performance. This contrasts with the substantial body of research demonstrating positive correlations between Conscientiousness in particular and academic and occupational performance (Barrick and Mount, 1991, O'Connor and Paunonen, 2007, Salgado, 2003). Interestingly, Agreeableness was positively related to interview performance ($r = .21$), suggesting those dental students who were compassionate and considerate tended to perform better in their entrance interviews.

Chamberlain et al. (2005) also investigated the use of personality measures in predicting the performance of Canadian dental students. They investigated the relationship between personality and a quantitative measure of professionalism, and

compared the personality profiles of the students to qualified dental practitioners. Their sample of 87 students came from the entire cohort of students enrolled at a single Canadian dental school. 56% were female and 44% male reflecting the gender composition of the entire student body. 130 qualified dental professionals also participated, with a gender breakdown of 70% male and 30% female. This study also used the NEO-PI-R.

Conscientiousness positively correlated with academic performance ($r = .23$ to $.47$) which is consistent with the existing literature (O'Connor and Paunonen, 2007), but contrasts with the finding of Smithers et al. (2004) discussed earlier. High Conscientiousness and low Neuroticism correlated with higher scores on a measure of professionalism developed for the study ($r = .29$ and $r = -.27$ respectively). A number of narrow facets were also correlated with both academic and clinical performance, as well as professionalism scores. Their hierarchical regression analysis found the broad personality factors of Conscientiousness and Neuroticism to explain an additional 7% of the variance in professionalism scores over and above control variables. However, only Conscientiousness was a significant predictor of professionalism score. Entering those facet traits seen to correlate with professionalism into the regression model explained substantially more variance in professionalism scores. More specifically, Deliberation, a facet of Conscientiousness, and Ideas, a facet of Openness, were significant predictors of professionalism.

The researchers found significant differences between the personalities of dental students and qualified professionals for each of the Big Five, although the absolute size of these differences was small. Those students whose personalities most closely matched qualified dental professionals demonstrated better performance in their first

year of studies, but this did not hold for the other two years of training or for scores on professionalism.

The results of this study evidence the influence of personality, particularly Conscientiousness, on academic and professional outcomes. They also suggest students with personalities similar to qualified dental professional may fare better in their studies. However, the authors did not account for confounding demographic variables such as age and gender in their multivariate analysis despite finding a correlation between Neuroticism and female gender of .45.

Hoad-Reddick et al. (1999) investigated the relationship between personality and performance at the dental school admission interview, as well as the first year of undergraduate studies. Their analysis was performed on a sample of 58 students for the relationship with first year results and 54 for the relationship with the admission interview score. The Orpheus personality inventory was used and is based on the FFM with each of five Orpheus factors mapping to one of the Big Five. The authors found applicants with low Agreeableness scored higher for communication skills at interview, and those higher in Conscientiousness scored higher in leadership skills. They also found students lower in Agreeableness and higher in Conscientiousness were less likely to fail course-based examinations, however the lower limit of the confidence interval for the odds ratio was only marginally above zero. The small sample size in this study, along with an apparent absence of a formal power calculation, limits confidence in their findings. Furthermore, despite the authors claiming the Orpheus inventory to have undergone extensive validation, they do not cite this research and a search of the literature did not find it.

Finally, Belsi et al. (2011) investigated personality differences amongst dental undergraduates (with a distinction made between direct entrants, graduate entrants and medical graduate entrants) and trainee dental care professionals, namely dental nursing and dental hygiene/therapy students. Their sample comprised of a total of 148 students and the NEO-PI-R inventory was used. Multiple ANOVAs were run with each of the Big Five taken in turn as dependent variables and type of student, ethnic group and gender taken in turn as the independent variable. When students were grouped by their programme of study, significant differences were seen in Extraversion, Agreeableness and Neuroticism. The authors detail the specific pair-wise comparisons that were significant but the post-hoc analysis employed is not stated.

This study suggests there are differences in personality between dental professionals when they are still in training. A principal weakness is that, as would be expected from previous research (Goldberg et al., 1998), there are personality differences between males and females in this sample but this confounder is not accounted for in the analysis. The authors do not specify what the gender breakdown of respondents in each student group is and it is possible the different proportions of males and females in each group could account for some of the differences in personality observed between types of student. Age may have a similar influence although this is more unlikely given the relatively small standard deviation in age seen in the sample as a whole.

In summary, the studies investigating personality in dental students are inconsistent in their approach to controlling for relevant confounders such as age and gender (Goldberg et al., 1998). Multivariate analysis provides a means of achieving this as well as determining the relationship between personality and professional group over

and above the influence of demographic variables known to correlate with personality. Finally, these studies did not test the psychometric properties of their data through factor analysis. This would help establish the validity of the inventory used and determine the applicability of the Five Factor Model to their samples (Lee and Ashton, 2007).

1.15 Importance of the Research

Dental professionals stand to benefit if this research identifies a common personality profile amongst registrants, either as a whole or in their subgroups. Assuming those unsuited to a given role would remove themselves from it, those currently practising are groups of individuals whose success or persistence in their role is attributable in some part to their personality (Holland, 1997, Schneider, 1987). Consequently, aspiring professionals would be able to make comparisons between their personality profile and for example an “orthodontic personality profile”, if indeed such a thing exists, to better determine their suitability for the role. Selectors would also be able to identify applicants with personalities which would suit their training programmes and institution, with obvious advantages for both parties. Finally, defining the personality of current registrants will allow for the detection of any changes in personality created by a greater application of psychometric testing in the future. The results of this investigation could produce a useful repository of normative data for future researchers wishing to draw comparisons between qualified dental professionals and other groups, for example applicants to dental school or specialty training.

2 Aims and Objectives

Aim:

To examine personality traits in dental professionals and OMF surgeons and how these may be influenced by individual demographics.

Objectives:

- To measure personality traits of dental nurses, GDPs, orthodontists and OMF surgeons using a validated psychometric test.
- To compare the five factors of Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness, as well as narrower personality facets across groups.
- To examine the relationship between individual demographics (age, gender, education, geographical location, and relationship status) and personality.
- To determine if, in this sample, there is an association between personality and job satisfaction.
- To confirm if the structure of personality in the sample conforms to the FFM.

3 Methods

3.1 Design

A cross-sectional survey utilising a validated psychometric test, the Big Five Inventory (BFI).

3.2 Population

GDPs, orthodontists (consultants, primary care specialists and specialty registrars), OMF surgeons (consultants and specialty registrars), dental nurses.

The eligibility criteria are stated in Table 1 below.

Inclusion	Exclusion
Access to and adequate proficiency in using the internet	Insufficient IT proficiency to fill out necessary documents
Registered with the General Dental Council or General Medical Council in one of the 4 registrant groups being investigated	Lack of capacity to provide valid consent
≥ 18 years of age	

Table 1 – The inclusion and exclusion criteria for participation

3.3 Sample Size Calculation

The sample size was determined through consultation with a research statistician. A correlation of 0.20 would be considered a small to medium effect size based on findings in the personality literature (Cohen, 2013). Furthermore, the typical correlation uncovered in research investigating personality is 0.21 (Fraley and Marks, 2007). A statistical power analysis was performed for sample size estimation as below:

For analysis with ANOVA, where $f = 0.2$ would be considered a small to medium effect size (Cohen, 1992). In order to have power = 0.8 with an alpha = 0.05, this study required a sample of approximately 46 per group for the simplest between group comparison. Given the four registrant groups being compared, a necessary minimum sample size of 184 was required.

3.4 Setting

Data was collected online and participants recruited from primary and secondary care dental settings in the UK.

3.5 Materials

An online questionnaire which respondents accessed via a weblink. This collected demographic data and contained the BFI. Figure 1 shows the first five items from the BFI as they appeared in the online questionnaire. These consist of a short statement to which the participant gives a response on a 1 to 5 Likert scale denoting the extent to which they agree the statement applies to them. Table 2 gives a brief outline of the entire questionnaire. The questionnaire can be viewed in its entirety via this hyperlink: <https://leeds.onlinesurveys.ac.uk/dentalpersonalitysurvey>

Please select the response that most closely represents you for each statement:

	1. Strongly disagree	2. Disagree	3. Neither disagree or agree	4. Agree	5. Strongly Agree
1. Is talkative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Tends to find fault with others	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Does a thorough job	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Is depressed, blue	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Is original, comes up with new ideas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1 - The first five items from the BFI showing the short statements and the five possible responses on the Likert scale.

Information about the study and consent	
Outline of survey	
Survey Section 1 – About You	Collects demographic data on age, gender, ethnicity, partner status, and geographical location
Survey Section 2 – Your Education and Work	Collects data on qualifications, occupations, time spent in role, and job satisfaction
Survey Section 3 – Your Personality	Contains the 44-item BFI
Thanks for participation and signposting to further information	

Table 2 - An outline of the online Questionnaire

The questionnaire was piloted amongst eight volunteers, two from each of the four occupations being studied. Refinements to the questionnaire were made in response to feedback and all volunteers agreed to avoid submitting any further responses to the study to avoid contamination of the data from those who have completed elements of the questionnaire on more than one occasion. The participant journey is outlined in Figure 2.

3.6 Recruitment Strategy

Participants were recruited through professional dental associations and societies. UK dental schools were approached through administrative staff and professional societies contacted via the publicly available contact information. These organisations were asked to disseminate a participant information sheet and a link to the study questionnaire to their members via email. This provided an overview of the research, the contact details of the principal investigator, and explained the rights of the participant.

Study details were also made available to potential participants on social media groups. These groups were limited to dental professionals where members have

consented to being approached about such research as a condition of their membership.

In person recruitment via stalls at national conferences was planned, however restrictions associated with the Covid-19 pandemic made such recruitment unfeasible.

3.7 Data Collection

Data was collected through a questionnaire on the Online Surveys platform (Jisc, Bristol UK). This collected demographic data and contained the BFI. The questionnaire collected data on known confounders such as age, gender, marital status, and geographical location (John et al., 2008, Rentfrow et al., 2015, Costa et al., 2000, McCrae et al., 1998).

3.8 Outcomes

The outcomes of interest were:

- Significant differences between groups for each of the Big Five.
- Significant differences in the ten narrower personality facets of Assertiveness, Activity, Altruism, Compliance, Order, Self-Discipline, Anxiety, Depression, Aesthetics and Ideas.
- Associations between the Big Five and demographic variables.
- Associations between the Big Five and occupation after accounting for demographic variables.
- Associations between the Big Five and job satisfaction.

3.9 Ethical Approval

Ethical approval was sought from The University of Leeds Dental Research Ethics committee (DREC) after the questionnaire was piloted but before main data collection. This was granted on 06/10/2020 and the statement of approval is attached as Appendix 1. DREC ref: 180620/NA/300.

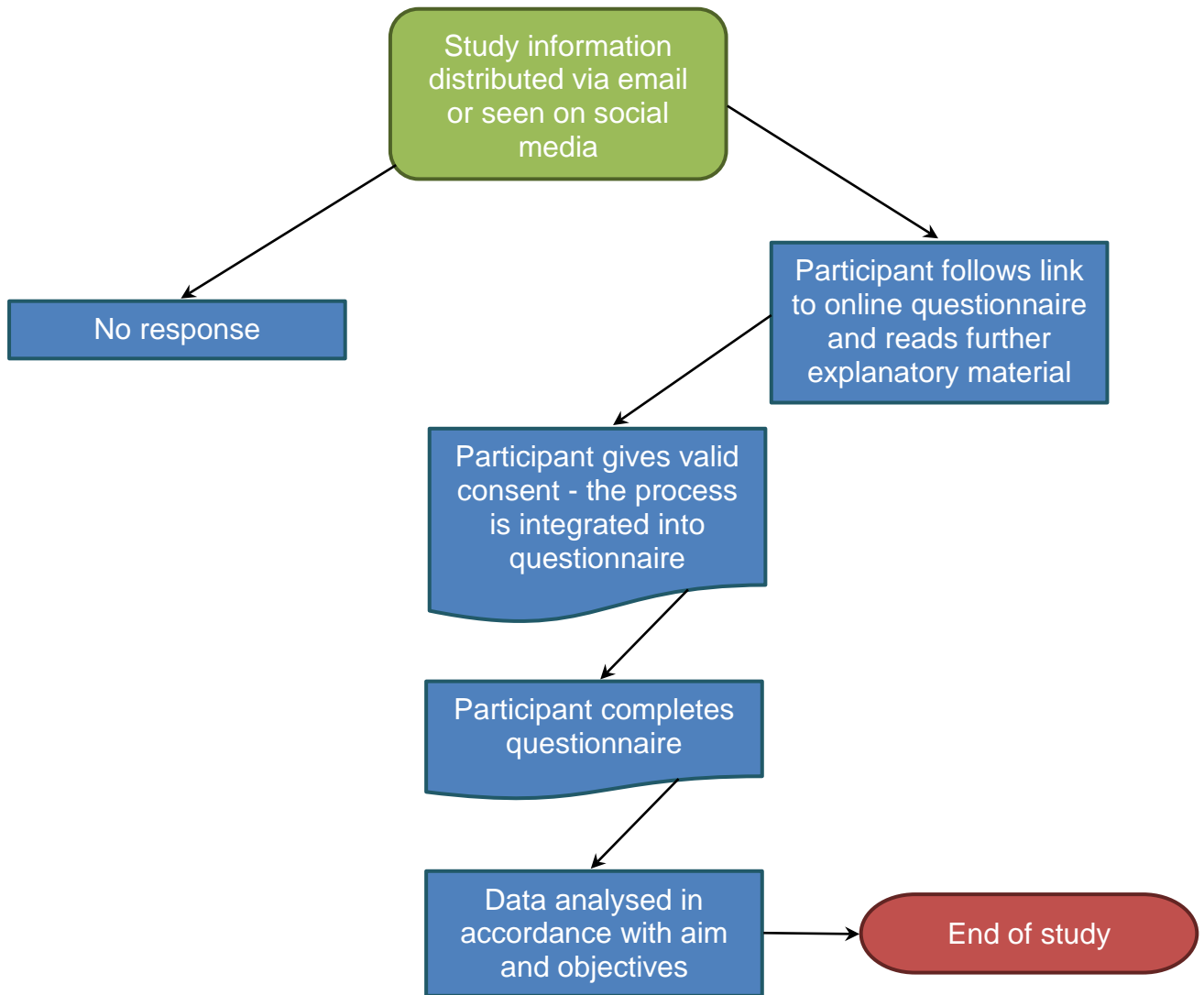


Figure 2 - Participant journey through the study.

3.10 Statistical Analysis Plan

3.10.1 Descriptive Statistics

The descriptive statistics using data on the demographic variables of age, gender, ethnicity, relationship status, and geographical location were calculated and presented for each of the four professional groups. Descriptive statistics were also calculated for level of education, and time spent in professional role. The normally distributed continuous variables were presented as means and standard deviations, and categorical variables as frequency and percentage. Comparisons were made using ANOVA or chi-square/Fisher's exact test to determine any significant differences between groups at the $p = 0.05$ significance level.

3.10.2 Outcomes of Interest

The statistical analysis was conducted with the input of an expert in the field of psychometric testing as well as a research statistician. The outcome of interest was any significant differences between groups for each of the Big Five personality traits. A score for each was derived from responses to the BFI using the scoring instructions and SPSS syntax provided by the authors of the inventory. A mean factor score, ranging from 1 to 5 was derived for each trait. This is the average of scores on the five-point Likert scale for all questions pertaining to a given trait, after accounting for those items that are reverse-keyed. A low score denotes lower levels of a given trait and vice versa. ANOVA and post-hoc pairwise comparisons were used to detect any significant differences between groups. A Bonferroni correction was applied to account for multiple pairwise comparisons.

Soto and John (2009), developed and validated 10 facet scales for the 44-item BFI. For example, Extraversion was seen to subsume the facets of Assertiveness and Activity. These facets were used to draw comparisons on more specific personality characteristics between the professionals in the study.

3.10.3 Personality and Demographic Characteristics

Previous research has found personality differences between individuals when they are grouped by demographic variables such as age, gender, and relationship status (Scollon and Diener, 2006, Robins et al., 2002, Roberts et al., 2006, McCrae and Terracciano, 2005b, McCrae and Terracciano, 2005a, Goldberg et al., 1998). Reference to the literature guided the selection of which demographic variables should be captured by the survey so that associations in this sample between personality and demographic variables could be contrasted with those already established in previous work.

Personality differences between the occupations could be explained by the distribution of demographic variables in each occupation rather than by occupation membership itself. For example, dental nurses may have had a higher mean Agreeableness score as the majority of dental nurses are female and females consistently score higher than males on this trait (Costa Jr et al., 2001). The differences between professional groups could therefore be explained by variables other than occupational group membership. To account for this, personality differences, when participants were grouped by demographic variables, were investigated. Pearson's correlation, Student's t-tests and analysis of variance (ANOVA) were used to determine whether such personality differences were present (Robins et al., 2009). They were then controlled for through hierarchical multiple regression analysis.

3.10.4 Statistical Tests

Pearson's correlation is used to determine the strength of a linear relationship between two continuous variables. The test generates a coefficient, denoted as r , which gives the strength and direction of any such relationship. Values for r can range from -1 to 1, with 0 denoting no correlation and positive and negative values denoting positive and negative correlations respectively. This was used to assess the relationship between age and the Big Five.

The independent samples t-test is used to determine if a statistically significant difference exists between the means of two independent groups on a continuous dependent variable. Here it was used to assess differences in the Big Five between male and female participants.

A one-way ANOVA is used to determine if there are statistically significant differences between the means of two or more independent groups on a continuous dependent variable. It is an omnibus test and so itself does not specify which groups differed, but rather establishes that a significant difference exists between any of the groups of the independent variable. Post-hoc follow-up tests were used to determine which groups had significant differences and a Bonferroni correction was applied to account for multiple comparisons. ANOVA was used to assess differences in the Big Five between occupational groups.

Finally, the chi-square test is used to determine whether a statistically significant difference exists between the binomial proportions of three or more independent groups on a dichotomous independent variable. This was used to determine whether there were significant differences between occupations in the proportion of males and females in each occupation and the proportion of individuals with and without a

partner. For chi-square, each 'cell' of the crosstabulation showing the frequency of participants must be equal to or greater than five. When this assumption was violated a Fisher's exact test was run instead but for the same purpose.

Data was entered and analysed using SPSS v26 (SPSS Inc. Chicago, Illinois, USA).

3.10.5 Multiple Regression

This is used to predict a continuous dependent variable based on multiple independent variables. Hierarchical multiple regression (HMR) was employed as it allowed for sets of variables to be added to a regression equation to see how much each set of variables uniquely added to the prediction of the dependent variable. This is expressed as the relative increase in R^2 , which is the proportion of variance in the dependent variable explained by the independent variables.

In our analysis, HMR was used to determine whether occupational group membership predicted differences in personality over and above demographic characteristics which have been shown to correlate with personality in existing research. Each of the Big Five were taken in turn as the dependent variable in a HMR equation, the demographic variables were entered first, followed by occupation which was the independent variable of interest.

3.10.6 Factor Analysis

Factor analysis was performed for the psychometric personality data to assess the nature of the latent personality variables for the study sample. A principal component extraction and varimax rotation was employed. This approach is the one that has been most frequently used when validating the BFI (Benet-Martínez and John, 1998, Lovik et al., 2017). This tested assumptions regarding the five-factor structure of personality

central to the inventory used, and confirmed whether or not personality in the study sample conformed to the FFM.

4 Results

4.1 Respondents

Data was collected from October 2020 to January 2021. A total of 1010 individuals completed the questionnaire.

4.2 Response Rate

It is not possible to accurately estimate the response rate as recruitment was done online. There is no way to determine the *active* membership of any Facebook groups used, nor is it possible to estimate how many Twitter users saw the link to the survey but did not respond. The survey was distributed via the British Orthodontic Society which has constituent groups representing specific categories of professionals such as the Consultant Orthodontists' Group and the University Teachers' Group. Total group membership cannot however be used to estimate response rate amongst orthodontists as an individual may belong to more than one group at a time or they may have received the survey link through some other avenue of recruitment.

4.3 Respondents Excluded from Analysis

Of the 1010 responses received 103 selected the 'other' option in response to the question 'Select the option that best describes your job role'. These responses were analysed and none corresponded to one of the four groups being investigated so were excluded from further analysis. A single case showed facetious responses, stating an age of 105 and giving straight-line responses to almost all items including reverse-

keyed items in the BFI. This individual was removed from further analysis. The characteristics of the remaining 906 respondents are summarised below.

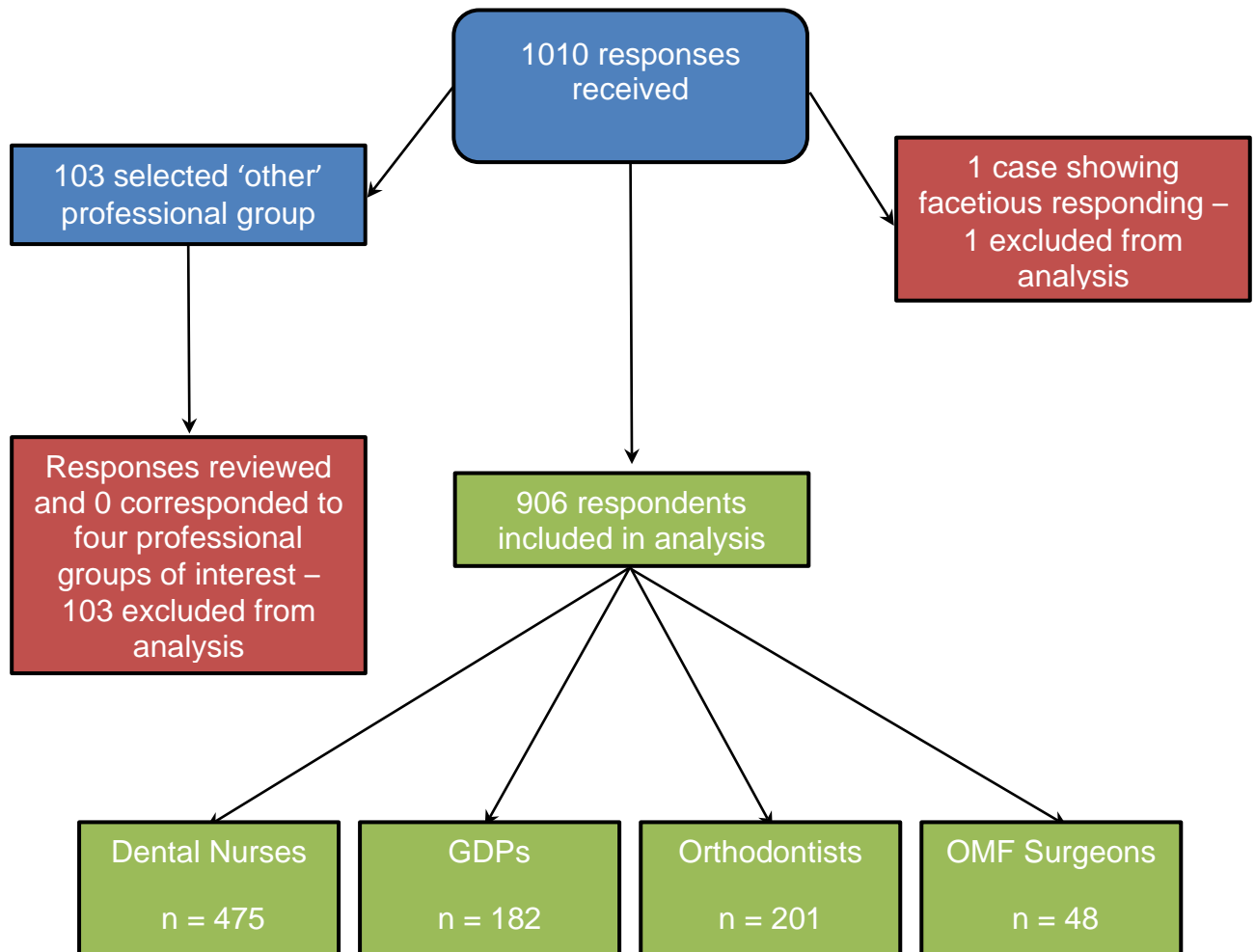


Figure 3 - Responses and their inclusion/exclusion from analysis.

4.4 Characteristics of the Sample

Data from the GDC and published literature were used to determine the extent to which the sample was representative. This was also done to appreciate what proportion of the UK population of each of the four occupations was captured in the sample (Table 3).

There are 58,728 Dental Nurses in the UK. 815 male (1.39%) and 57,913 female (98.61%) (General_Dental_Council, 2020). There are also 38,603 GDPs in the UK. 18,598 males (48.12%) and 20,005 females (51.82%). This figure was calculated by subtracting the total number of specialists ($n = 4,404$) from the total number of dentists ($n = 43,007$). The same was done for each gender. This will be a slight underestimation as a few dentists appear on more than one specialist list (General_Dental_Council, 2020). There are 1409 UK Orthodontists (this does not include trainees). 690 male (48.97%), 719 female (51.03%) (General_Dental_Council, 2020). There are a total of 691 OMFS specialists and trainees in the UK. Where data on gender was available, 79 (12%) were female and 496 (88%) male (Magennis et al., 2020).

Taken together, there are a total of 99,431 dental nurses, GDPs, orthodontists and OMF surgeons in the UK. This figure includes OMFS trainees but not orthodontic trainees.

Professional Group	Total numbers in UK	Total in Sample	Proportion in population (%)	Proportion in sample (%)
Dental nurses	58,728	475	59.1	52.4
GDPs	38,603	182	38.8	20.1
Orthodontists	1,409	201	1.4	22.2
OMFS surgeons	691	48	0.7	5.3
Total	99,431	906	100	100

Table 3 - The numbers and proportion of dental professionals in the UK and in the study sample.

Table 4 below summarises the characteristics of each of the four occupations and denotes whether differences between occupations were statistically significant.

	Dental nurses n = 475		GDPs n = 182		Orthodontists n = 201		OMFS surgeons n = 48		Test Statistic	p value
	n/M	%/SD	n/M	%/SD	n/M	%/SD	n/M	%/SD		
Age	38.63	10.44	38.65	11.27	47.11	12.04	43.92	8.41	F(3, 902) = 32.506	< 0.001
Gender									χ² Sig diff in proportion of m and f across all four groups	< 0.001
Male	4	.8	53	29.1	92	45.8	35	72.9		
Female	471	99.2	127	69.8	108	53.7	13	27.1		
Rather not say	-	-	2	1.1	1	.5	-	-		
Ethnicity										
White	462	97.3	141	77.5	154	76.6	32	66.7		
Mixed/multiple ethnic groups	4	.8	1	.5	5	2.5	3	6.3		
Asian/Asian British	5	1.1	33	18.1	28	13.9	12	25.0		
Black/African/Caribbean/Black British	3	.6	-	-	2	1.0	-	-		
Other ethnic group	1	.2	7	3.8	12	6.0	1	2.1		
Marital Status										
Single	163	34.3	71	39.0	39	19.4	6	12.5		
Married	235	49.5	96	52.7	147	73.1	35	72.9		
Civil Partnership	9	1.9	0	0	1	.5	1	2.1		
Divorced	33	6.9	7	3.8	9	4.5	4	8.3		
Widowed	5	1.1	1	.5	2	1.0	1	2.1		
Other	30	6.3	7	3.8	3	1.5	1	2.1		

	Dental nurses n = 475		GDPs n = 182		Orthodontists n = 201		OMFS surgeons n = 48		Test Statistic	p value
	n/M	%/SD	n/M	%/SD	n/M	%/SD	n/M	%/SD		
Partner Status										
Partner	272	57.3	102	56.0	151	75.1	36	75.0		
No Partner	203	42.7	80	44.0	50	24.9	12	25.0		
Job Satisfaction Score ^a	3.65	.85	3.61	.96	4.33	.64	4.23	.73	Welch's $F(3, 195.642) = 52.990$	< 0.001

^a Mean on a 5 point Likert scale

n = frequency

M = mean

% = proportion

SD = standard deviation

Table 4 - Descriptive statistics for the sample grouped by occupation. Means and SD used where data approximately normally distributed.

4.5 Measuring the Personality of the Four Occupations

4.5.1 The Big Five

The personality of respondents was measured using their responses to the BFI. This provides scores for each of the Big Five. Scoring instructions and SPSS syntax were kindly provided by the authors of the inventory. A mean factor score, ranging from 1 to 5 was derived for each trait. This is the average of scores on the five-point Likert scale for all the questions pertaining to a given personality factor, after accounting for those items that are reverse-keyed. A low score denotes lower levels of a given trait and vice versa. Table 5 shows the mean scores for each of the Big Five across the four occupations. It also denotes whether any group differences were statistically significant.

	Dental nurses n = 475		GDPs n = 182		Orthodontists n = 201		OMFS surgeons n = 48		Test Statistic	p value
	n/M	%/SD	n/M	%/SD	n/M	%/SD	n/M	%/SD		
Personality Factors										
Extraversion	3.46	0.70	3.39	0.72	3.41	0.73	3.57	0.64	$F(3, 902) = 1.174$	0.319
Agreeableness	4.07	0.48	3.94	0.60	3.91	0.53	3.77	0.55	$F(3, 185.951) = 8.683$	< 0.001
Conscientiousness	4.23	0.48	3.95	0.54	4.18	0.48	4.02	0.53	$F(3, 902) = 15.379$	< 0.001
Neuroticism	2.76	0.70	2.76	0.74	2.55	0.63	2.33	0.65	$F(3, 902) = 9.360$	< 0.001
Openness	3.47	0.48	3.51	0.54	3.56	0.54	3.61	0.56	$F(3, 902) = 2.237$	0.08

Table 5 – The mean scores for each of the Big Five across the four occupations, as well as the statistical significance of any group differences based on ANOVA.

4.5.2 The Ten Facets

Personality facets are more specific elements of personality which sit under, and are subsumed by, the Big Five in a hierarchical structure. Soto and John (2009), developed and validated 10 facet scales for the BFI. Like for the Big Five, the BFI provides a mean facet score based on responses to items rated on a 5-point Likert scale. There are a total of 10 facets, two per Big Five Domain. These are Assertiveness and Activity in the Extraversion domain, Altruism and Compliance in the Agreeableness domain, Order and Self-Discipline in the Conscientiousness domain, Anxiety and Depression in the Neuroticism domain, and Aesthetics and Ideas in the Openness domain. Table 6 summarises the mean scores for each facet across the four occupations and denotes whether any group differences were statistically significant.

	Dental nurses n = 475		GDPs n = 182		Orthodontists n = 201		OMFS surgeons n = 48		Test Statistic	p value
	M	SD	M	SD	M	SD	M	SD		
Personality Facets										
Assertiveness	3.34	0.82	3.31	0.82	3.25	0.85	3.43	0.71	$F(3, 902) = 0.835$	0.475
Activity	3.63	0.80	3.42	0.83	3.70	0.70	3.80	0.72	$F(3, 902) = 5.624$	0.001
Altruism	4.22	0.53	4.03	0.63	4.00	0.59	3.90	0.61	$F(3, 902) = 11.785$	< 0.001
Compliance	3.79	0.65	3.77	0.77	3.70	0.69	3.54	0.64	$F(3, 902) = 2.450$	0.049
Order	4.12	0.81	3.71	0.92	3.98	0.80	3.72	0.93	$F(3, 902) = 12.309$	< 0.001
Self-Discipline	4.15	0.51	3.95	0.55	4.21	0.52	4.02	0.56	$F(3, 902) = 8.992$	< 0.001
Anxiety	2.80	0.78	2.78	0.81	2.57	0.68	2.19	0.67	$F(3, 902) = 12.500$	< 0.001
Depression	2.63	0.87	2.58	0.87	2.25	0.87	2.36	0.86	$F(3, 902) = 9.934$	< 0.001
Aesthetics	3.30	0.68	3.41	0.75	3.45	0.79	3.30	0.84	$F(3, 902) = 2.444$	0.077
Ideas	3.45	0.53	3.51	0.60	3.59	0.57	3.70	0.64	$F(3, 902) = 4.756$	0.003

Table 6 – The mean scores for each of the ten facets across the four occupations, as well as the statistical significance of any group differences based on ANOVA.

4.6 Personality Differences Between Occupations

One-way ANOVA tests were run with each of the five personality factors taken in turn as dependent variables.

The goal in a one-way ANOVA is to examine differences in group means on a single, continuous variable. Each of the Big 5 were analysed and interpreted separately. For the purposes of this analysis, respondents were sorted into the broadest group to which they belonged i.e. specialty registrars in orthodontics were grouped with consultants and specialists in orthodontics.

In order to run a one-way ANOVA, a number of assumptions must be considered.

- There must be one dependent variable which is continuous in nature. In this study each of the Big Five satisfy this assumption.
- There must be a single independent variable with two or more categorical, independent groups. The participants were grouped by their occupation.
- There should be independence of observations. This is satisfied as there is no relationship between the participants in each of the groups and the groups are mutually exclusive.
- There should be no significant outliers.
- The dependent variable (personality factor score from the BFI) should be normally distributed for each group of the independent variable.
- There should be homogeneity of variances i.e. the variance in personality factor score should be similar for each registrant group.

The results of the ANOVA for each of the Big Five are summarised in Table 5. Being an omnibus test, the ANOVA did not specify where any differences between groups lied and so was followed up with post-hoc tests to identify the precise nature of any significant differences. A Bonferroni correction was applied for the post-hoc tests to account for multiple pairwise comparisons. The p value was divided by 6, the total number of possible pairwise comparisons, to give a Bonferroni adjusted p value of 0.008.

ANOVA attempts to identify whether differences between group means are statistically significant. Like other null hypothesis significance tests, it infers whether the differences observed between groups in the sample are likely to be present in the population and consequently whether the null hypothesis should be rejected. It does not itself provide an indication of the size of said differences and so partial eta squared (η^2) and omega squared (ω^2) were calculated to determine the size of any statistically significant differences between groups.

The different numbers of respondents in each group, (dental nurses $n = 475$, general dental practitioners $n = 182$, orthodontists $n = 201$, and OMF surgeons $n = 48$) resulted in an unbalanced design. This has the potential to violate the assumptions on the validity of the ANOVA and relevant modifications to the procedure were made to account for this.

The ANOVA for each of the five personality factors is covered below along with tests to determine whether the data satisfied the necessary assumptions.

4.6.1 Extraversion

For Extraversion, there was a single outlier, as assessed by boxplot; data was normally distributed for each group, as assessed by visual inspection of Normal Q-Q plots; and there was homogeneity of variances as assessed by Levene's test for homogeneity of variances ($p = 0.51$).

The mean Extraversion scores for the four groups were similar. OMF surgeons had the highest Extraversion scores on average ($n = 48, 3.57 \pm 0.64$), followed by dental nurses ($n = 475, 3.46 \pm 0.70$), then orthodontists ($n = 201, 3.41 \pm 0.73$), with GDPs having the lowest scores ($n = 182, 3.39 \pm 0.72$).

The differences between the groups were not statistically significant, $F(3, 902) = 1.174$, $p = 0.319$. Running the ANOVA with the aforementioned outlier (Extraversion score = 1.25) removed did not result in a statistically significant result.

4.6.2 Agreeableness

Several outliers were identified and kept in the analysis as there was no theoretically valid reason to remove them. Running the ANOVA with and without the outliers did not change the significance of the result. Data were normally distributed for each group as assessed by visual inspection of Q-Q Plots. The assumption of homogeneity of variances was violated, as assessed by Levene's test for equality of variances ($p = 0.004$) and so a Welch's ANOVA was run.

Dental nurses had the highest mean Agreeableness score ($n = 475, 4.07 \pm 0.48$), followed by GDPs ($n = 182, 3.94 \pm 0.60$), then orthodontists ($n = 201, 3.91 \pm 0.53$), with OMF surgeons having the lowest score ($n = 48, 3.77 \pm 0.55$).

These differences were statistically significant, Welch's $F(3, 185.951) = 8.683$, $p < 0.001$, $\eta^2 = 0.028$. This is a small effect sizes according to Cohen (1992) as conventionally, $\eta^2 = 0.01$ indicates a small effect; $\eta^2 = 0.06$ indicates a medium effect; $\eta^2 = 0.14$ indicates a large effect. Omega squared (ω^2) is an alternative measure of effect size calculated from partial eta squared and uses unbiased measures of the variance components. This was $\omega^2 = 0.025$ and also denoted a small effect size (Warner, 2012).

Games-Howell post hoc analysis, with a Bonferroni adjusted α level of .008, revealed dental nurses to have significantly higher Agreeableness scores compared to GDPs and OMF surgeons. Dental nurses had a mean Agreeableness score which was 0.16 (95% CI, 0.05 to 0.27) higher than orthodontists ($p = 0.002$), and 0.30 (95% CI, 0.10 to 0.50) higher than OMF surgeons ($p = 0.001$).

No other differences were statistically significant.

4.6.3 Conscientiousness

Visual inspection of boxplots identified three outliers. The ANOVA was run with and without these to identify their impact on the results. These were virtually the same whether the outliers were included or excluded from analysis. Visual inspection of Normal Q-Q Plots found the data to be normally distributed for each group.

Dental nurses had the highest mean Conscientiousness score ($n = 475$, 4.23 ± 0.48), followed by orthodontists ($n = 201$, 4.18 ± 0.48), then OMF surgeons ($n = 48$, 4.02 ± 0.53), with GDPs having the lowest mean score ($n = 182$, 3.95 ± 0.54). There was homogeneity of variances as assessed by Levene's test ($p = 0.08$).

There were statistically significant differences in Conscientiousness between groups, $F(3, 902) = 15.379$, $P < 0.001$, $P\eta^2 = 0.049$, $\omega^2 = 0.045$. This is a small to medium effect size (Cohen, 1992).

The Tukey-Kramer post-hoc test, with a Bonferroni adjusted α level of .008, found the following statistically significant differences:

Dental nurses had a mean Conscientiousness score 0.28 (95% CI, 0.17 to 0.39) higher than GDPs ($p < 0.001$).

Orthodontists had a mean Conscientiousness score 0.23 (95% CI, 0.10 to 0.36) higher than GDPs ($p < 0.001$).

No other group differences were statistically significant.

4.6.4 Neuroticism

Two outliers were identified through visual inspection of boxplots. There was no difference in statistical significance when the ANOVA was run with outliers included or excluded. Visual inspection of Normal Q-Q plots found the data to be normally distributed for each group.

Dental nurses had the highest mean Neuroticism score ($n = 475$, 2.76 ± 0.70), However this was virtually identical to GDPs ($n = 182$, 2.76 ± 0.74). The next highest was orthodontists ($n = 201$, 2.55 ± 0.63) and finally OMFS surgeons had the lowest Neuroticism scores on average ($n = 48$, 2.33 ± 0.65).

There was homogeneity of variances as assessed by Levene's test ($p = 0.15$).

There were statistically significant differences in Neuroticism between groups, $F(3, 902) = 9.360$, $p < 0.001$, $P\eta^2 = 0.030$, $\omega^2 = 0.027$. These are small to medium effect

sizes (Warner, 2012, Cohen, 1992). Again, owing to the unequal number of participants in each group, the Tukey-Kramer post-hoc test was used, with Bonferroni adjustment as previously described. The following statistically significant differences were found:

Dental nurses had a mean Neuroticism score 0.21 (95% CI, 0.06 to 0.36) higher than orthodontists ($p = 0.002$) and 0.43 (95% CI, 0.16 to 0.70) higher than OMF surgeons ($p < 0.001$).

GDPs had a mean Neuroticism score 0.43 (95% CI, 0.14 to 0.71) higher than OMF surgeons ($p = 0.001$)

No other group differences were statistically significant.

4.6.5 Openness

Visual inspection of boxplots identified three outliers which were included in the analysis. Their exclusion did not result in a statistically significant result at the $p = 0.05$ level. Data were again normally distributed when assessed through visual inspection of Normal Q-Q Plots.

OMF surgeons had the highest mean Openness score ($n = 48, 3.61 \pm 0.56$), followed by orthodontists ($n = 201, 3.57 \pm 0.54$), then GDPs ($n = 182, 3.51 \pm 0.54$), with dental nurses having the lowest score ($n = 475, 3.47 \pm 0.48$).

There was homogeneity of variances as assessed by Levene's test ($p = 0.74$). There were no statistically significant differences in Openness between the groups, $F(3, 902) = 2.237, p = 0.08$.

4.7 Facet Level Differences in Personality

One-way ANOVA tests were run to determine if there were any statistically significant mean differences between occupational groups for the ten facets. Where outliers were seen on visual inspection of boxplots, the ANOVA was run with and without these included to assess any meaningful impact on the results. The inclusion or exclusion of outliers did not change the statistical significance of any differences. Visual inspection of Q-Q Plots found the data to be approximately normally distributed for each facet for each of the four groups. There was a tendency towards negative skew for the facets of Altruism, Self-discipline, and order, although still within acceptable limits for analysis through ANOVA. The results of the ANOVA tests are summarised in Table 7.

	Sig. of Levene's Test	F	Sig.
Assertiveness	.416	.835	.475
Activity	.042	5.624	.001
Altruism	.296	11.785	<.001
Compliance	.033	2.450	.049
Order	.008	12.309	<.001
Self-Discipline	.434	8.992	<.001
Anxiety	.011	12.500	<.001
Depression	.996	9.934	<.001
Aesthetics	.002	2.444	.077
Ideas	.121	4.756	.003

Table 7 - Results from ANOVA tests summarising any homogeneity of variance and significant differences between groups for the 10 facets.

No statistically significant differences were found for the facets of Assertiveness, Compliance and Aesthetics. Where the assumption of equality of variances was violated, as assessed by Levene's test, a Welch ANOVA was run and Games-Howell post-hoc test used to identify where the differences between groups lay. Significance

for the post-hoc pairwise comparisons was set at an alpha of 0.008 after Bonferroni adjustment to account for multiple comparisons.

4.7.1 Assertiveness

OMF surgeons had the highest Assertiveness score ($n = 48, 3.43 \pm 0.71$), followed by dental nurses ($n = 475, 3.34 \pm 0.82$), then GDPs ($n = 182, 3.31 \pm 0.82$), with orthodontists having the lowest mean score ($n = 201, 3.25 \pm 0.85$).

None of the differences between groups were statistically significant.

4.7.2 Activity

OMF surgeons had the highest mean Activity score ($n = 48, 3.80 \pm 0.72$), followed by orthodontists ($n = 201, 3.70 \pm 0.70$), then dental nurses ($n = 475, 3.63 \pm 0.8$), with GDPs having the lowest mean score ($n = 182, 3.42 \pm 0.83$).

Orthodontists had a mean Activity score 0.28 (95% CI, 0.08 to 0.48) higher than GDPs ($p = 0.002$).

No other group differences were statistically significant.

4.7.3 Altruism

Dental nurses had the highest mean Altruism score ($n = 475, 4.22 \pm 0.53$), followed by GDPs ($n = 182, 4.03 \pm 0.63$), then orthodontists ($n = 201, 4.00 \pm 0.59$), with OMF surgeons having the lowest mean score ($n = 48, 3.90 \pm 0.61$).

Dental nurses had a significantly higher Altruism score relative to the other groups. It was 0.19 (95% CI, 0.06 to 0.33) higher than GDPs ($p = 0.001$), 0.22 (95% CI, 0.09 to

0.34) higher than orthodontists ($p < 0.001$) and 0.32 (95% CI, 0.08 to 0.56) higher than OMF surgeons ($p = 0.001$).

No other group differences were statistically significant.

4.7.4 Compliance

Dental nurses had the highest mean Compliance score ($n = 475$, 3.79 ± 0.65), followed by GDPs ($n = 182$, 3.77 ± 0.77), then orthodontists ($n = 201$, 3.70 ± 0.69), with OMF surgeons having the lowest mean score ($n = 48$, 3.54 ± 0.64).

None of the differences between groups were statistically significant.

4.7.5 Order

Dental nurses had the highest mean Order score ($n = 475$, 4.12 ± 0.81), followed by orthodontists ($n = 201$, 3.98 ± 0.80), then GDPs ($n = 182$, 3.71 ± 0.92), with scores virtually identical to OMF surgeons ($n = 48$, 3.72 ± 0.93).

Dental nurses had an Order score 0.41 (95% CI, .21 to .61) higher than GDPs ($p < 0.001$).

No other group differences were statistically significant.

4.7.6 Self-discipline

Orthodontists had the highest mean Self-discipline score ($n = 201$, 4.21 ± 0.52), followed by dental nurses ($n = 475$, 4.15 ± 0.51), then OMF surgeons ($n = 48$, 4.02 ± 0.56), with GDPs having the lowest mean score ($n = 182$, 3.95 ± 0.55).

Orthodontists had a Self-discipline score 0.25 (95% CI, .11 to .39) higher than GDPs ($p < 0.001$).

Dental nurses had a Self-discipline score 0.20 (95% CI, 0.08 to 0.32) higher than GDPs ($p = < 0.001$).

No other group differences were statistically significant.

4.7.7 Anxiety

Dental nurses had the highest mean Anxiety score ($n = 475$, 2.80 ± 0.78), closely followed by GDPs ($n = 182$, 2.78 ± 0.81), then orthodontists ($n = 201$, 2.57 ± 0.68), with OMF surgeons having the lowest score ($n = 48$, 2.19 ± 0.67).

Dental nurses had a mean Anxiety score 0.23 (95% CI, 0.07 to 0.38) higher than orthodontists ($p = 0.001$) and .61 (95% CI, 0.34 to 0.88) higher than OMF surgeons ($p < 0.001$).

GDPs had a mean anxiety score 0.60 (95% CI, 0.30 to 0.89) higher than OMF surgeons ($p < 0.001$).

Finally, orthodontists had a mean Anxiety score 0.39 (95% CI, 0.10 to 0.67) higher than OMF surgeons ($p = 0.003$).

No other group differences were statistically significant.

4.7.8 Depression

Dental nurses had the highest mean Depression score ($n = 475$, 2.63 ± 0.87), followed by GDPs ($n = 182$, 2.58 ± 0.87), then OMF surgeons ($n = 48$, 2.36 ± 0.86), with orthodontists having the lowest score ($n = 201$, 2.25 ± 0.87).

Dental nurses had a mean Depression score 0.38 (95% CI, 0.19 to 0.58) higher than orthodontists ($p < 0.001$).

No other group differences were statistically significant.

4.7.9 Aesthetics

Orthodontists had the highest mean Aesthetics score ($n = 201, 3.45 \pm 0.79$), followed by GDPs ($n = 182, 3.41 \pm 0.75$), then dental nurses ($n = 475, 3.30 \pm 0.68$) and OMF surgeons ($n = 48, 3.30 \pm 0.84$) having virtually identical mean scores.

None of the differences between groups were statistically significant.

4.7.10 Ideas

OMF surgeons had the highest mean Ideas score ($n = 48, 3.70 \pm 0.64$), followed by orthodontists ($n = 201, 3.59 \pm 0.57$), then GDPs ($n = 182, 3.51 \pm 0.60$), with dental nurses having the lowest score ($n = 475, 3.45 \pm 0.53$).

Despite a statistically significant result for the ANOVA, pairwise comparison with the Tukey HSD test did not find any significant differences between groups at the Bonferroni adjusted alpha of 0.008.

4.8 Differences in Personality Based on Demographics

4.8.1 Participant Age

Statistically significant correlations were seen between age and three of the Big Five.

These are summarised in the table below:

Personality Factor	Pearson's <i>r</i>	<i>p</i> value
Extraversion	0.018	0.580
Agreeableness	0.021	0.537
Conscientiousness	0.11	< 0.001
Neuroticism	- 0.18	< 0.001
Openness	0.08	0.016

Table 8 - Correlations between age and personality.

4.8.2 Gender

Table 3 shows the proportion of males and females in the study sample and how it compares with the proportions of males and females in each occupation in the UK.

Only three of the respondents elected not to state their gender giving insufficient numbers to draw a meaningful comparison between them and those identifying as male ($n = 184$) or female ($n = 719$).

A chi-square test of homogeneity was conducted between occupation and gender to assess if there were statistically significant differences in the proportions of males and females for the four occupations. All expected counts were greater than five and the difference in proportions was statistically significant, $p = < .001$. Post hoc testing with a z-test of two proportions and Bonferroni adjustment found all pairwise comparisons to have statistically significant differences, indicating the proportions of males and females was different for all four occupations.

The mean personality scores for each trait were normally distributed for both males and females when assessed through visual inspection of Normal Q-Q plots. The mean and standard deviation for each of the trait scores for males and females is summarised in the table below:

	Gender	Mean	Std. Deviation
Extraversion	Male	3.44	0.73
	Female	3.44	0.71
Agreeableness	Male	3.84	0.57
	Female	4.04	0.50
Conscientiousness	Male	4.02	0.56
	Female	4.19	0.48
Neuroticism	Male	2.53	0.71
	Female	2.73	0.69
Openness	Male	3.66	0.56
	Female	3.47	0.49

Table 9 - Mean and SD of the personality score for males and females.

There was homogeneity of variances for males and females, as assessed by Levene's test for equality of variances, for the traits of Extraversion ($p = 0.739$), Agreeableness ($p = 0.055$), Neuroticism ($p = 0.585$) and Openness ($p = 0.056$). The assumption of homogeneity of variances was violated for Conscientiousness ($p = 0.004$)

An independent samples Welch t-test, comparing the mean personality trait scores for males and females, was run to determine if any differences between the genders were statistically significant. A Welch t-test was used due to the unequal number of males and females (Howell, 2012). Significant differences for Agreeableness, Conscientiousness, Neuroticism, and Openness were found. These are summarised below:

Females had significantly higher Agreeableness scores than males. Mean difference 0.20 (95% CI, 0.11 to 0.29), $t(260.678) = 4.300$, $p < 0.001$, $d = 0.27$.

Females also had Conscientiousness scores statistically significantly higher than males. Mean difference 0.16 (95% CI, 0.07 to 0.25), $t(256.786) = 3.621$, $p < 0.001$, $d = 0.25$.

Female Neuroticism scores were significantly higher than males. Mean difference 0.20 (95% CI, 0.09 to 0.32), $t(278.015) = 3.498$, $p = 0.001$, $d = 0.48$

Finally, Males had Openness scores significantly higher than females. Mean difference 0.19 (95% CI 0.10 to 0.28) $t(261.085) = 4.251$, $p < 0.001$. $d = 0.26$

Effect sizes are given as Cohen's d with all values denoting a small to medium effect size (Cohen, 2013).

4.8.3 Ethnicity

A one-way ANOVA was run to determine if there were any significant differences between individuals when they were grouped by their ethnicity. Statistically significant differences were seen for some personality traits but these concerned the ethnic groups with small sample sizes giving a high probability such findings were due to chance.

4.8.4 Relationship Status

One-way ANOVAs were run on the entire sample to examine the relationship between marital status and personality traits. Statistically significant differences between participants were seen for the traits of Conscientiousness, $F(5, 900) = 3.474$, $p =$

0.004, $P\eta^2 = 0.02$, and Neuroticism $F(5, 900) = 6.516$, $p < 0.005$, $P\eta^2 = 0.035$. These results denote a small effect size (Cohen, 2013).

With regards to Conscientiousness, married participants had a mean score of 4.20 ± 0.50 and single participants had a lower mean score of 4.06 ± 0.51 . Tukey-Kramer post hoc analysis found this difference (0.14, 95% CI 0.04 to 0.25) to be statistically significant ($p = 0.002$).

For Neuroticism, married participants had a mean score of 2.61 ± 0.68 whereas single participants had a higher mean score of 2.86 ± 0.72 . Post hoc analysis found this difference (0.25 95% CI 0.10 to 0.39) to also be statistically significant ($p = 0.001$). No other statistically significant group differences were seen.

Given the influence of marital status on personality traits, this demographic variable was factored into the multivariate analysis with a dichotomous distinction drawn between individuals with and without a partner.

4.8.5 Education

When participants were grouped by their highest level of education, a sizeable proportion tend to fall into their professional grouping. For this reason of redundancy, a further analysis of personality differences by differing levels of education was not performed

4.8.6 Geographical Location

Data were collected on geographical location using the UK census categories. No significant differences were found between individuals living in different geographical areas when analysed with ANOVA.

4.9 Job Satisfaction

Job satisfaction scores were obtained using a scale previously employed in an extensive UK personality survey (Rentfrow et al., 2015). This contains 5 items rated on a Likert scale from 1 to 5. A higher score denotes higher levels of job satisfaction. The questions can be seen in Appendix 2. The scores obtained are summarised in Table 4.

Orthodontists had the highest mean job satisfaction score ($n = 201, 4.33 \pm 0.64$), followed by OMF surgeons ($n = 48, 4.23 \pm 0.73$), then dental nurses ($n = 3.65 \pm 0.85$), and finally GDPs had the lowest scores ($n = 182, 3.61 \pm 0.96$)

The differences between groups were statistically significant when analysed with ANOVA, Welch's $F(3, 195.642) = 52.990, p < 0.001, \eta^2 = 0.118$ which denotes a moderate to large effect size (Cohen, 2013).

Games-Howell post hoc analysis, with a Bonferroni adjusted α level of .008, found orthodontists and OMF surgeons to have significantly higher job satisfaction scores compared to dental nurses and GDPs ($p < 0.001$). Orthodontists had a mean score 0.68 (95% CI, 0.49 to 0.87) higher than dental nurses and 0.72 (95% CI, 0.45 to 0.99) higher than GDPs. OMF surgeons had a mean score 0.59 (95% CI, 0.22 to 0.96) higher than dental nurses and 0.63 (95% CI, 0.21 to 1.04) higher than GDPs.

No other differences were statistically significant.

4.10 Multivariate Analysis and Accounting for Confounders

As can be seen from the descriptive statistics and ANOVA, there were statistically significant differences between occupations for the personality factors of Conscientiousness, Agreeableness and Neuroticism. Table 4 and the statistics it summarises also shows there to be significant differences in demographic variables between the four occupations. For example, the sample of dental nurses was composed almost entirely of females. This does, however, reflect the proportions in the population – see Table 3.

Once these differences in personality were identified, a hierarchical multiple regression analysis was performed for each of the Big Five where significant differences were seen. This was to determine whether the difference in personality trait could be explained by occupation, over and above any personality differences related to demographic characteristics.

Hierarchical multiple regression allows for sets of variables to be added to a regression equation to see how much each set of variables uniquely adds to the prediction of the dependent variable. This is expressed as the relative increase in R^2 . In the following analysis the potential confounders, i.e. the demographic variables known to correlate with personality, were entered into the regression equation first. After this the independent variable of interest, occupation, was entered into the equation and its importance assessed after the confounding demographic variables had been controlled for.

The first set of variables added were age, gender, and partner status. These were found to correlate with personality in our sample and in the literature. Partner status

did not significantly add to the prediction of personality for any of the regression models. Ethnicity and geographic location were not entered, as although previous has found these to correlate with personality, this was not seen in this sample, with the number participants likely too small to detect such differences and be on a par with the existing literature which identified them.

4.10.1 Data Setup

Variables were incorporated into the multiple regression model by means of the enter method.

Age was entered as continuous variable. Gender was coded as male = 0 and female = 1. The three individuals that selected 'rather not to say' were removed from the analysis as they would form a group of too small a size to make any inferences valid. Relationship status was coded as partner = 0 and no partner = 1 in a similar manner to published research which has made the same dichotomous distinction (González Gutiérrez et al., 2005). The free text responses for the 'other' marital status option were reviewed, and where participants described a long-term relationship or cohabiting, they were placed into the partner group.

Ethnicity was not entered as an independent variable as most groups had inadequate numbers to make appropriate statistical inferences. Grouping respondents by a dichotomous white/non-white variable was considered, but this would unnecessarily treat the non-white participants as a homogenous group without a theoretical basis to make this distinction.

Geographical region was also omitted from multivariate analysis as no statistically significant differences were found between individuals living in different geographical areas in this present sample.

Education and time spent in role were not entered due to a risk of multicollinearity. As expected, age demonstrated a strong correlation with time in role (Pearson's $r = 0.71$), and grouping individuals by their highest level of education placed them approximately into their occupational groups, likely as a result of the nature of the different training process for each role.

Multiple regression relies on eight assumptions being met:

- A single continuous dependent variable. Here, this consisted of the personality factors Conscientiousness, Agreeableness and Neuroticism taken in turn.
- Two or more independent (predictor) variables that are either continuous or nominal. Here these will be age, gender, partner status and occupation.
- There should be independence of errors.
- There should be a linear relationship between the predictor variables and the dependent variable.
- There should be homoscedasticity of residuals.
- There should be no multicollinearity.
- There should be no significant outliers, high leverage points or highly influential points.
- The errors should be approximately normally distributed.

The first two assumptions are satisfied by the study design. There was no reason to expect observations to be related, again owing to the study design, and so the third

assumption was also satisfied. The remaining assumptions will be considered in what follows.

4.10.2 Multiple Regression – Conscientiousness

A hierarchical multiple regression was run to determine if occupation was associated with the personality trait of Conscientiousness over and above the demographic variables of age, gender and partner status. The addition of partner status did not lead to a significant increase in R^2 and consequently this variable was omitted from the full model. See Table 10 for details on each regression model.

A scatterplot of the studentized residuals plotted against the (unstandardized) predicted values confirmed a linear relationship between the independent variables, taken collectively, and Conscientiousness score as the dependent variable.

Homoscedasticity is seen when the variance is equal for all values of the predicted dependent variable. The plot of the studentized residuals against the unstandardized predicted values was used to assess this and showed homoscedasticity.

Multicollinearity occurs when two or more independent variables are highly correlated with one another. It is then difficult to determine which variable is contributing to the variance explained by the model. None of the independent variables had correlations greater than 0.7. All tolerance values were greater than 0.1 again suggesting the assumption of no collinearity being satisfied by these data.

Three participants had standardized residuals and studentized deleted residuals greater than ± 3 standard deviations. As they had the potential to undermine statistical inference, and given the aberrance of their values, these cases were removed from the analysis and the regression run again. The model produced was contrasted with

one where the outliers were retained. The R^2 for the model with outliers removed was virtually identical to that when they were included. The model with outliers included is presented here.

No high leverage points were identified (Huber, 2004). Cook's Distance was used to check for high influence points and no cases were found to have Cook's Distance values greater than 1.

Inferential statistics require the residuals in a multiple regression to be normally distributed. This was assessed through a histogram of the standardized residuals and a P-P plot.

The histogram showed the standardized residuals to approximately normally distributed and the approximate values for the mean and standard deviation to be zero and 1, respectively. The P-P plot confirmed the approximately normal distribution of residuals therefore the assumption of normality was satisfied.

The full model of age, gender and occupation (entered as dummy variables with orthodontists as the reference category) was statistically significant, $R^2 = .072$, $F(5, 897) = 13.819$, $p < 0.001$, adjusted $R^2 = .066$.

The addition of gender to the regression model (Model 2) led to a statistically significant increase in R^2 of .024 $F(1, 900) = 22.883$, $p < 0.001$.

The addition of occupation to the regression model (Model 3) also led to a statistically significant increase in R^2 of .029. $F(3, 897) = 9.293$, $p < 0.001$. This confirmed that occupation was correlated with personality over and above the demographic variables known to correlate with it in the literature and seen to correlate with it in this sample.

Conscientiousness						
Variable	Model 1		Model 2		Model 3	
	B	β	B	β	B	β
Constant	3.91**		3.71**		3.81**	
Age	.006**	.14	.007**	.16	.007**	.15
Gender			.19**	.16	.13*	.10
Occupation						
Dental Nurse					.04	.04
GDP					-.19**	-.15
OMFS Surgeon					-.11	-.05
R^2	.018		.043		.072	
F	16.82**		20.85**		13.82**	
ΔR^2	.018		.024		.029	
ΔF	16.82**		22.88**		9.23**	

Note. $N = 903$. * $p < .01$, ** $p < .001$. For

Gender: male(ref)

Role: orthodontist(ref)

Model 1: Age

Model 2: Age, gender

Model 3: Age, gender, occupation

Table 10 - Hierarchical multiple regression model for Conscientiousness

4.10.3 Multiple Regression – Agreeableness

A further hierarchical multiple regression procedure was run to test whether occupation was predictive of Agreeableness after accounting for demographic variables. The same assumption testing procedures as outlined above were performed. Again, the addition of partner status did not lead to a significant increase in R^2 and consequently this variable was omitted from the full model. See Table 11 for full details on each regression model.

There was linearity and homoscedasticity as assessed by visual inspection of a plot of studentized residuals against unstandardised predicted values. A partial regression plot confirmed linearity for the single continuous independent variable of age. There was no evidence of multicollinearity as no independent variables had correlations greater than 0.7 and there were no tolerance values less than 0.1. Two participants had studentized deleted residuals greater than ± 3 standard deviations. The regression model was run with and without these outliers and the R^2 for the model with outliers removed was virtually identical to that when they were included. The model with outliers included is presented here. There were no leverage values greater than 0.2, and no influential points which would be denoted by Cook's distance values greater than 1. The assumption of normality was again met when assessed by Q-Q plot.

The full model of age, gender, and occupation (with orthodontists as the reference category) was statistically significant, $R^2 = .038$, $F(5, 897) = 7.092$, $p < 0.001$, adjusted $R^2 = .033$. The addition of gender to the prediction of Agreeableness (Model 2) led to a statistically significant increase in R^2 of .025, $F(1, 900) = 23.399$, $p < 0.001$. The addition of occupation to the model (Model 3) also led to a statistically significant

increase in R^2 of .012, $F(3, 897) = 3.744$, $p < 0.001$. Therefore occupation was correlated with Agreeableness even after accounting for age and gender.

Agreeableness						
Variable	Model 1		Model 2		Model 3	
	B	β	B	β	B	β
Constant	3.95**		3.73**		3.69**	
Age	.001	.03	.002	.05	.003*	.07
Gender			.21**	.16	.12*	.09
Occupation						
Dental Nurse					.14*	.13
GDP					.06	.14
OMFS Surgeon					-.10	-.04
R^2	.001		.026		.038	
F	.597		12.01**		7.09**	
ΔR^2	.001		.025		.012	
ΔF	.597		23.40**		3.74*	

Note. $N = 903$. * $p < .05$, ** $p < .001$. For
Gender: male(ref)
Role: orthodontist(ref)
Model 1: Age
Model 2: Age, gender
Model 3: Age, gender, occupation

Table 11 - Hierarchical multiple regression model for Agreeableness

4.10.4 Multiple Regression – Neuroticism

A final hierarchical regression for personality was run with Neuroticism as the dependent variable. Again, the addition of partner status did not lead to a significant increase in R^2 and consequently this variable was omitted from the full model. Table 12 outlines the regression models.

There was linearity and homoscedasticity as assessed by visual inspection of a plot of studentized residuals against unstandardised predicted values. Age again demonstrated linearity when assessed by partial regression plot. There was no evidence of multicollinearity as no independent variables had correlations greater than 0.7 and there were no tolerance values less than 0.1. There were no studentized deleted residuals greater than ± 3 standard deviations, no leverage values greater than 0.2, and values for Cook's distance above 1. The assumption of normality was met when assessed by Q-Q Plot

The full model of age, gender and occupation (orthodontists again as the reference group) (Model 3) to predict Neuroticism was statistically significant, $R^2 = .058$, $F(5, 897) = 10.992$, $p < 0.001$, adjusted $R^2 = .052$. The addition of gender to the prediction of Neuroticism (Model 2) resulted in a statistically significant increase in R^2 of .007 $F(1, 900) = 6.749$, $p = 0.01$. The addition of occupation to the prediction of Neuroticism (Model 3) also led a statistically significant increase in R^2 of .010, $F(3, 897) = 3.162$, $p = 0.024$.

Neuroticism						
Variable	Model 1		Model 2		Model 3	
	B	β	B	β	B	β
Constant	3.20**		3.04**		3.02**	
Age	-.012**	-.20	-.011**	.19	-.011**	.17
Gender			.149*	.09	.064	.04
Occupation						
Dental Nurse					.093	.066
GDP					.092	.052
OMFS Surgeon					-.239*	-.077
R^2	.041		.048		.058	
F	38.16**		22.57**		10.99**	
ΔR^2	.041		.007		.010	
ΔF	38.16**		6.75*		3.16*	

Note. $N = 903$. * $p < .05$, ** $p < .001$. For

Gender: male(ref)

Role: orthodontist(ref)

Model 1: Age

Model 2: Age, gender

Model 3: Age, gender, occupation

Table 12 - Hierarchical multiple regression model for Neuroticism

4.10.5 Multiple Regression – Job Satisfaction

A final multiple regression was run to assess the relationship between personality and job satisfaction. The Big Five were entered as the independent variables with job satisfaction score as the dependent variable. Linearity was seen on partial regression plots of studentized residuals against the predicted values. Homoscedasticity was seen on visual inspection of a plot of studentized residuals against unstandardized predicted values. All tolerance values were greater than 0.1, providing no evidence for multicollinearity. Seven cases were found to have studentised deleted residuals greater than ± 3 standard deviations. These were first retained in the analysis before it was run again with the same statistically significant findings encountered on both occasions and only marginal differences seen in the size of the β coefficients of the two models. No cases had leverage values greater than 0.2 and none had a Cook's Distance greater than one, denoting an absence of high leverage and high influence points respectively. A Q-Q Plot satisfied the assumption of normality. The model statistically significantly predicted job satisfaction $F(5, 900) = 26.025, p < 0.001, \text{adj. } R^2 = .121$. The personality factors of Extraversion and Neuroticism were very highly significant in adding to the prediction of job satisfaction, $p < 0.001$. Regression coefficients are shown in Table 13 below:

Job Satisfaction Score							
	<i>B</i>	95% CI for <i>B</i>		<i>SE B</i>	β	<i>R</i> ²	ΔR^2
		<i>LL</i>	<i>UL</i>				
Model						.126	.121***
Constant	3.37***	2.60	4.15	.39			
Extraversion	.12**	.04	.20	.04	.10**		
Agreeableness	-.04	-.15	.07	.06	-.03		
Conscientiousness	.14*	.02	.26	.06	.08*		
Neuroticism	-.32***	-.41	-.24	.04	-.26***		
Openness	.14*	.03	.25	.06	.08*		

Note. Model = "Enter" method in SPSS Statistics; *B* = unstandardised regression coefficient; CI = confidence interval; *LL* = lower limit; *UL* = upper limit; *SE B* = standard error of the coefficient; β = standardised coefficient; *R*² = coefficient of determination; ΔR^2 = adjusted *R*². **p* < .05, ***p* < .01, ****p* < .0

Table 13 - Multiple regression for job satisfaction with personality traits as predictors.

4.11 Confirming the Five Factor Structure for the Sample

4.11.1 Factor Analysis

Factor analysis attempts to reduce many correlated variables to a few broader dimensions i.e. factors (Lee and Ashton, 2007). This was performed on the data attained to determine if it conformed to the FFM. Factor analysis with principal component extraction and varimax rotation was employed. This approach is the one that has been most frequently used when validating the BFI (Benet-Martínez and John, 1998, Lovik et al., 2017). The scree plot strongly suggested a five factor structure given the steep drop in Eigenvalue between components 5 and 6 (Figure 4).

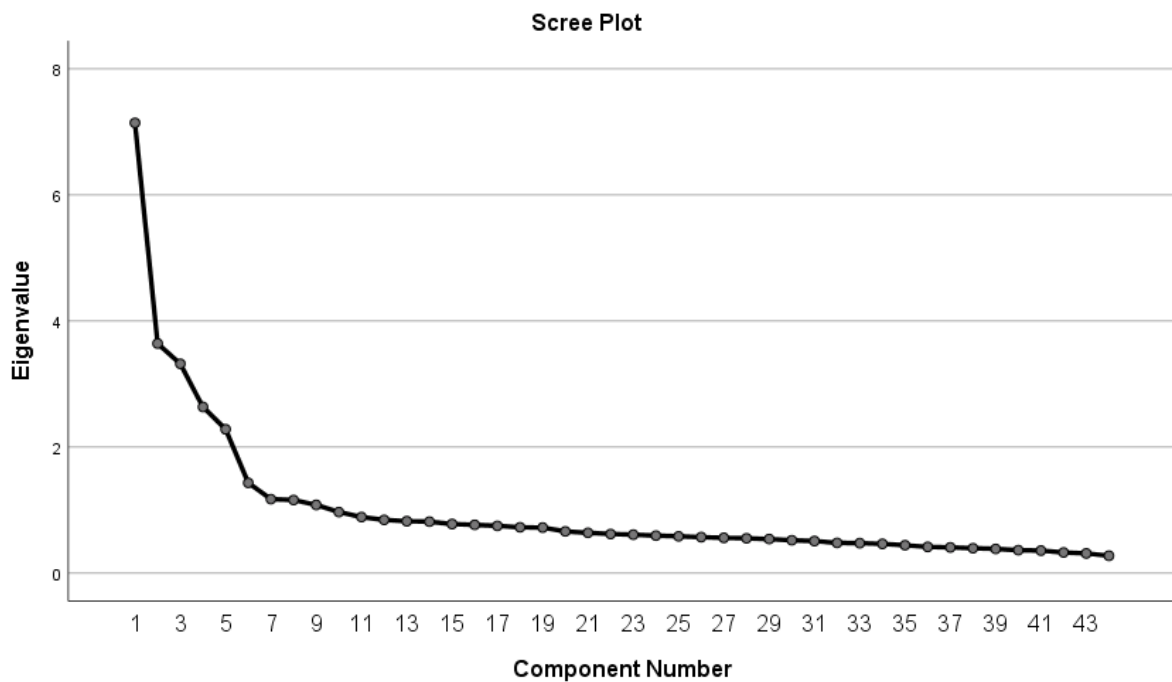


Figure 4 - Scree plot supporting a five factor structure to the latent personality variables measured by the BFI in the sample.

Appendix 3 shows the results of the factor analysis with varimax rotation and again supports an underlying 5 factor structure. This model explained 43% of the variance, a figure highly consistent with existing literature (Lovik et al., 2017).

4.11.2 Internal Consistency – Cronbach’s Alpha

Cronbach’s alpha was calculated to determine the internal consistency of questions specific to each of the five personality factors. Values closer to 1 indicate that the questions relating to a specific personality factor or facet are highly consistent and the scale is reliable.

The Cronbach’s alpha for the group of questions relating to each of the five personality factors is shown below:

Personality Factor	Cronbach’s Alpha
Extraversion	0.84
Agreeableness	0.77
Conscientiousness	0.78
Neuroticism	0.82
Openness	0.73

Table 14 - Cronbach’s alpha for the BFI scale items at the Big Five domain level

Cronbach’s alpha (α) greater than 0.7 is considered indicative of good internal consistency (DeVellis, 2016). For each of the five factors α was greater than 0.7 suggesting the items in the Big Five Inventory reliably measured their relevant factor in our sample of dental professionals.

The facet scales demonstrated moderate to strong reliabilities as summarised in Table 15. The average α was .56 (range = .46-.83). Although this is lower than the alpha reliabilities seen for the BFI at the Big Five domain level (see Table 14), they are acceptable given the brevity of the BFI. They are also similar to those achieved by Soto and John (2009) when developing the facet scales.

Personality Facet	Cronbach's Alpha
Assertiveness	.83
Activity	.68
Altruism	.63
Compliance	.56
Order	.46
Self-discipline	.68
Anxiety	.75
Depression	.46
Aesthetics	.51
Ideas	.64

Table 15 - The alpha reliabilities for the 10 BFI facet scales

4.12 RIASEC Categorisation of the Four Occupations

Holland's (1997) RIASEC model and the O*NET database were used to describe the nature of each occupation in an objective, consistent, and valid manner.

Both the interests of an individual, as they pertain to their preferred type of work, and occupations themselves can be described in terms of the RIASEC model (Holland, 1997). Occupational environments differ in the extent to which they are Realistic, Investigative, Artistic, Social, Enterprising and Conventional.

The O*NET database is a publicly available resource which contains information on approximately 1000 occupations (Eggerth et al., 2005). It describes each occupation in terms of a score from 1-100 for each RIASEC domain. The ratings are established by subject experts and previous research has established the validity of these scores (Rounds et al., 1999, Wille and De Fruyt, 2014).

Each of the four occupations in this present study were entered in turn as search terms into the O*NET database. Exact matches were retrieved for all of the occupations except dental nurses as this is not a familiar term in the United States where the O*NET database was developed. The role of the 'dental assistant' is essentially identical and the scores for this occupation were used instead. Table 16 summarises the RIASEC scores for each occupation.

Occupation	R	I	A	S	E	C
Dental nurse	78	39	6	61	28	83
GDP	72	100	11	50	22	33
Orthodontist	72	100	11	61	39	22
OMF surgeon	83	67	11	78	33	28

Table 16 - The RIASEC scores for each occupation from the O*NET database.

5 Discussion

5.1 Key Findings

1. There were significant differences in the Big Five trait domains of Agreeableness, Conscientiousness, and Neuroticism between dental nurses, GDPs, orthodontists, and OMF surgeons:
 - Dental nurses had higher Agreeableness relative to orthodontists ($p = 0.002$) and OMF surgeons ($p = 0.001$).
 - Orthodontists and dental nurses had greater Conscientiousness relative to GDPs ($p < 0.001$).
 - Orthodontists and OMF surgeons had lower Neuroticism relative to dental nurses ($p = 0.002$).
 - The differences were small to moderate in size ($\omega^2 = 0.025$ to 0.047).
2. The demographic variables of age, gender, and marital status were associated with differences in personality which were largely consistent with those found in the published literature.
3. Occupation was associated with differences in personality even after controlling for the influence of these demographic variables using multivariate analysis.
4. There were significant differences in job satisfaction between occupations ($p < 0.001$):
 - Orthodontists and OMF surgeons had higher job satisfaction relative to dental nurses and GDPs.
 - These differences were moderate to large in size ($P\eta^2 = 0.118$).Personality was significantly associated with job satisfaction.
5. Personality in the sample conformed to the FFM.

5.2 Measuring Personalities of the Four Occupations

This cross-sectional survey of UK dental professionals used a validated personality inventory based on the prevailing FFM, the BFI, to measure the personality of four occupations: dental nurses, GDPs, orthodontists, and OMF surgeons. The required sample size, based on a statistical power calculation, was satisfied. The number of participants makes this one of the largest surveys of personality in these professionals to date.

The BFI generates scores from 1 to 5 for each of the Big Five and the mean scores for each personality domain along with norms from for the UK population are summarised in Table 17 below. A higher figure represents a higher level for a given trait. In addition, the BFI also generates scores for more specific personality facets which are subsumed by the Big Five. The lead author for the study which provided the norms for the Big Five was contacted for facet-level normative data. Unfortunately, although this data was collected, it remains unpublished and will form the basis of future work by that research team.

Personality Factors	Dental nurses n = 475		GDPs n = 182		Orthodontists n = 201		OMFS surgeons n = 48		Population norms n = 386,375	
	M	SD	M	SD	M	SD	M	SD	M	SD
Extraversion	3.46	.70	3.39	.72	3.41	.73	3.57	.64	3.24	.82
Agreeableness	4.07	.48	3.94	.60	3.91	.53	3.77	.55	3.74	.62
Conscientiousness	4.23	.48	3.95	.54	4.18	.48	4.02	.53	3.65	.70
Neuroticism	2.76	.70	2.76	.74	2.55	.63	2.33	.65	2.97	.81
Openness	3.47	.48	3.51	.54	3.57	.54	3.61	.56	3.67	.64

Table 17 - Mean and SD for the Big Five for each occupation as well as population norms from Rentfrow et al. (2015).

5.3 Personality Differences Between Occupations

Analysis with ANOVA found significant differences in Agreeableness, Conscientiousness and Neuroticism between the occupations. Consistent with the literature, differences were also seen when participants were grouped by demographic variables namely age, gender, and to a lesser extent, marital/relationship status. Hierarchical multiple regression was used to control for demographic characteristics and associations between occupation and personality were still found to be statistically significant for the aforementioned traits.

5.3.1 Extraversion, Assertiveness, and Activity

Extraversion implies an energetic approach towards social interaction and a tendency towards positive emotionality. There were no significant differences in Extraversion between the groups. This may reflect the fact that each occupation requires substantial interpersonal interaction with both the public and colleagues and so they are likely to be homogenous in terms of this trait. Holland's (1997) RIASEC model of occupational choice would suggest that those not suited to such occupations would self-select out of them and those that remain would have somewhat similar personalities. The four occupations are undeniably different in terms of day-to-day tasks, however high levels of Extraversion would likely be advantageous in any of them and it is difficult to conceive of scenarios where higher levels of trait Extraversion would confer a disadvantage. The standard deviations for each of the groups were also highly similar, showing that the spread of scores amongst individuals was relatively consistent.

The mean Extraversion score in the UK population, based on a sample of over 388,000 adults, was 3.24 ± 0.82 (Rentfrow et al., 2015). All four groups had higher mean scores

than the population average, which again supports the assertion that these four occupations require greater than average levels of Extraversion, or at least attract such individuals.

The BFI provides scores for two lower order traits, Assertiveness and Activity, which are subsumed by Extraversion. The former describes an individual's tendency to make their preferences known or to take charge in situations and latter describes a tendency towards being more energetic (McCrae and Costa, 2003).

No significant differences were seen in Assertiveness, however orthodontists had a mean Activity score 0.28 (95% CI, 0.08 to 0.48) higher than GDPs ($p = 0.002$). It is difficult to elucidate why this difference exists as there appears to be no occupational reason why levels of Activity should differ between the two professions. Both require a similar level of interaction with colleagues and patients and the qualitative nature of said interactions is not dissimilar. Furthermore, although the difference was highly significant, the lower bound of the 95% CI is approaching zero and so the size of this difference may well be marginal and perhaps of little consequence.

5.3.2 Agreeableness, Altruism, and Compliance

Agreeableness is characterised by co-operation with others and a reluctance to be antagonistic. Dental nurses had the highest mean Agreeableness scores, followed by GDPs, then orthodontists, with OMF surgeons having the lowest scores. ANOVA found there to be statistically significant differences in Agreeableness between groups ($p < 0.001$). The effect size of this difference was small from a statistical perspective ($\eta^2 = 0.028$ where $\eta^2 = 0.01$ indicates a small effect; $\eta^2 = 0.06$ indicates a medium effect; $\eta^2 = 0.14$ indicates a large effect (Cohen, 1992)). Dental nurses had higher mean levels of this trait compared to orthodontists and OMF surgeons, but not GDPs.

This may be a reflection of the uniqueness of dental nursing. In terms of a dental or surgical team, it would be the clinician or operator that takes the leadership role and provides instruction to the dental nurse so that they may support in the delivery of patient care (General_Dental_Council, 2013a). Therefore, dental nurses may require higher levels of Agreeableness such that they may teamwork effectively with a broad variety of clinicians. Moreover, dental nurses who are likely to remain in the role long term, and gain satisfaction from it, would likely enjoy such team-working dynamics. This is consistent with Holland's RIASEC model of occupational choice which categorises nursing as a career which attracts 'Social' personality types i.e. those individuals that like to work with people and are concerned with the welfare of others (Holland, 1997). Meta-analytic work has found strong overlap between those categorised as Social types and those high in Agreeableness providing further theoretical explanation as to why such differences in this trait were found (Holland, 1999, Barrick et al., 2003). Furthermore, Woods et al. (2016) found higher Agreeableness to be associated with working in more social medical specialties and made similar conclusions on the likely propensity of individuals higher in Agreeableness to self-select into occupations requiring more social interaction.

Alternatively, these differences in Agreeableness may be a reflection of the differences in the proportions of males and females that make up each occupation, both in the study sample and in the population of dental professionals (Tables 3 and 4). Previous research has found females to score higher in Agreeableness and the results of this study are consistent these previous findings (Table 9) (Weisberg et al., 2011, Feingold, 1994). Multiple regression was employed to control for the influence of demographic variables on personality. This found occupation to be associated with differences in Agreeableness even after controlling for both age and gender. However, the overall

model comprising of age, gender, and occupation, despite being statistically significant ($p < 0.001$), explained only 4% of the variance in this trait. This suggests the vast majority of the differences in Agreeableness are explained by factors other than those outlined above. This is both intuitive and consistent with the literature which invariably finds there to be more variation in personality within groups than between them, as both the genetic and environmental determinants of personality are vast (Vukasović and Bratko, 2015) and one's occupation is but one influence on and reflection of their personality (Woods et al., 2016, Wu, 2016).

The mean Agreeableness score for the UK population is 3.74 ± 0.62 (Rentfrow et al., 2015). In this study, all the groups surveyed had mean Agreeableness scores higher than the UK average. Woods et al. (2016) found individuals higher in Agreeableness to work in more Social specialties. Table 13 shows that all four occupations had relatively high RIASEC scores for the 'Social' domain, confirming the findings of this previous research. However, OMF surgery had the highest 'Social' score from the O*NET database (Table 16), and yet OMF surgeons were found to have the lowest mean Agreeableness scores implying that an individual's tendency to be co-operative forms but one of the reasons why they may choose a particular occupation.

Altruism is the tendency to increase the welfare of others through prosocial and co-operative behaviour and Compliance is the tendency to co-operate with requests (McCrae and Costa, 2003). Dental nurses had a significantly higher mean Altruism score relative to the other three groups. The difference was greatest between dental nurses and OMF surgeons and smallest between nurses and GPs. The confidence intervals for these differences were large with the lower bound approaching zero, reflecting the substantial individual differences between participants irrespective of

group, and the possibility of any true difference being relatively small. Regarding Compliance, none of the differences between groups were statistically significant.

The arguments proposed earlier for why dental nurses may exhibit higher scores for Agreeableness could also be applied to the facet of Altruism, although one would hypothesise that, for the same reasons, they would have higher levels of Compliance. Why this was not found to be the case is not immediately clear.

5.3.3 Conscientiousness, Order, and Self-discipline

Conscientiousness describes impulse control which facilitates goal-directed behaviour such as delaying gratification, following rules, and planning and completing tasks. There is an abundance of research which finds this trait to be linked to a host of positive outcomes from lower incidences of divorce to greater longevity (Roberts et al., 2007). In addition, meta-analytic work shows there to be a positive correlation between Conscientiousness and occupational performance (Barrick and Mount, 1991). It follows that recruiters would perhaps be most interested in this trait when considering applicants for a role.

In this study dental nurses were found to have the highest mean Conscientiousness, followed by orthodontists, then OMF surgeons and finally GDPs. The differences between groups were statistically significant ($p < 0.001$) with a small to moderate effect size seen ($P\eta^2 = 0.049$). More specifically, dental nurses had higher scores than GDPs, and orthodontists also had higher scores than GDPs, with no other differences being statistically significant. Multiple regression found occupation to be associated with Conscientiousness after accounting for both age and gender and the full model explained 7% of the variance in this trait.

The difference between dental nurses and GDPs may be explained by the highly different tasks performed in each role on a day-to-day basis. Preparation of the surgery, disinfection of instruments, and assisting with procedures could be described as 'Conventional' work according to Holland's (1997) RIASEC model. Conventional work frequently involves following pre-determined procedures and routines and there is typically an established hierarchy or line of authority (Holland, 1997). As can be seen in the RIASEC scores in Table 16, dental nurses had the highest loading on the Conventional domain, with the score being more than double that for any of the other groups. In support of this assertion, Gottfredson et al. (1993) found individuals higher in Conscientiousness to show a preference for Conventional work.

The higher Conscientiousness of orthodontists relative to GDPs may be a reflection of the longer training pathway of the former. Completion of specialty training in orthodontics requires at least a three-year period of postgraduate study beyond the training required to be a GDP. Selection onto the training programme presently requires success in a competitive process of national recruitment with different but no less competitive methods of recruitment being employed historically. The willingness to undergo the process needed to gain entry into specialty training, as well actually undergo the training itself, may reflect higher levels of Conscientiousness on average. This is supported by ample research which finds occupational attainment to correlate with Conscientiousness beyond factors such as socio-economic status and cognitive ability (Roberts et al., 2007, Wilmot and Ones, 2019).

Given the substantially longer training pathway of OMF surgeons one would expect to find higher levels of Conscientiousness amongst these professionals. This was not found to be the case and the difference between surgeons and GDPs did not reach

significance. This again highlights both the multiple and varied contributions to personality and the substantial inter-individual variation in this trait.

All groups had higher mean Conscientiousness scores relative to the UK population (3.65 ± 0.7). The variance in scores was also lower for each of the groups compared with population norms. Previous work has found healthcare professionals to have higher Conscientiousness relative to population norms and the differences seen between subcategories of healthcare professional was found to be lower than the difference between professionals and the wider population (Hoffman et al., 2010). This likely represents the necessity for higher levels of this trait in order to work effectively in the occupations studied.

Conscientiousness is represented by the two lower-order facets Order and Self-discipline. Individuals who score high on Order are well-organised and have a proclivity to plan and schedule (McCrae and Costa, 2003). Dental nurses had the highest Order score, followed by orthodontists, then GDPs and OMF surgeons who had nearly identical mean scores. The only significant differences was that seen between dental nurses and GDPs with the former having an Order score .41 higher (95% CI, .21 to .61) ($p < 0.001$). The reasons for this difference may well be the same as those posited earlier for the broader domain of Conscientiousness. More specifically, maintaining an ordered and well-organised surgery, as well as thorough knowledge of the day's patient list, contributes to effective assistance of the clinician and is central to success in a dental nursing role.

Self-discipline describes the ability to persevere with a task that is not immediately gratifying and to see it through to its completion (McCrae and Costa, 2003). Orthodontists had the highest Self-discipline score, followed by dental nurses, then

OMF surgeons, with GDPs having the lowest mean score. Mirroring what was seen for Conscientiousness, both dental nurses and orthodontists had significantly higher self-discipline scores than GDPs.

5.3.4 Neuroticism, Anxiety, and Depression

Neuroticism is the tendency towards negative emotionality such as feeling anxious, sad, or tense. Individuals higher in this trait tend to be more emotionally labile and are less even-tempered (McCrae and Costa, 2003). Neuroticism has been shown to correlate with negative life outcomes such as earlier mortality and a greater incidence of divorce (Roberts et al., 2007). With regards to occupational performance, meta-analytic work has found relatively weak negative correlations between Neuroticism and markers of occupational success. The exception is those at the highest extremes of Neuroticism whose functioning is consequently impaired (Barrick and Mount, 1991).

Dental nurses and GDPs had the highest mean Neuroticism scores and these were nearly identical. Orthodontists had the next highest score with OMF surgeons having the lowest. The differences between groups were statistically significant ($p < 0.001$) and the effect size small to moderate ($\eta^2 = 0.030$). Dental nurses were found to have higher scores than both orthodontists and OMF surgeons ($p < 0.001$), and GDPs had higher scores than OMF surgeons ($p = 0.001$).

One reason for these differences could be the gender breakdown of the occupations. In their meta-analysis Feingold (1994) found women to score higher in anxiety and Costa Jr et al. (2001) corroborated these findings, showing women to have elevated levels of Neuroticism relative to men. These differences are modest in magnitude, but given the different proportions of males and females in each occupational group, may explain the differences seen.

The sample of dental nurses was almost exclusively female and also had the joint highest scores for Neuroticism. Similarly, the ratio of female to male in the GDP sample was nearly 3:1, which may again explain the relatively higher Neuroticism scores. In contrast, there was an approximately even gender split for the orthodontist group and in the OMF surgeon group there was a 3:1 male to female ratio. Multivariate analysis was used to account for this and showed occupation to correlate with personality after accounting for the demographic variables of age and gender with the full model explaining 6% of the variance (Table 12). This is consistent with multivariate analyses conducted in previous research (Woods et al., 2016).

The low average Neuroticism score of the OMF surgeon group may be explained with reference to the unique nature of surgical work. All four of the occupations require one to work with their hands or use tools. However, the consequences for a procedural error in OMF surgery may be more significant than the dental occupations. Those higher in Neuroticism are unlikely to feel at ease working in such a context, especially when there is such ready attribution between surgical error and a severely negative patient outcome. Individuals high in trait Neuroticism are likely to avoid such a pressured working environment and so the mean score for this trait may be lower in this group relative to the others. The findings in this regard are therefore consistent with those from Woods et al. (2016).

It was once thought that personality traits underwent little change in adulthood (Costa Jr and McCrae, 1994), however more recent cross-sectional and longitudinal research has shown personality can and does change across the lifespan both at the population and individual levels (Roberts et al., 2006, Roberts and Mroczek, 2008). One variable which may influence the magnitude and nature of any changes is one's experiences

in the workplace (Woods et al., 2013) (Woods et al., 2019). An individual's occupation has the ability to mould their personality as shown in work by Woods et al. (2020) which found occupation to predict adult personality in ways not related to the same individual's childhood personality when it was assessed fifty years earlier. In some instances, work experiences were in fact stronger predictors of adult personality than childhood traits. This suggests a degree of personality development occurs through 'inhabiting' an occupation over a period of time, and differences in Neuroticism may be explained by different levels of stress and across the four occupations.

Research has found general dental practice to be a highly stressful working environment and much evidence is testament to the high levels of stress these dental professionals experience in their working lives (Myers and Myers, 2004, Collin et al., 2019). Denton et al. (2008) found there to be lower levels of stress and burnout amongst dentists with postgraduate qualifications. Although they did not make a distinction between GDPs and specialists, given the latter will almost certainly have completed postgraduate education one could conclude that there may be lower levels of stress amongst specialists relative to GDPs. Collin et al. (2019) surveyed 2053 UK dentists and found 58.7% of GDPs to report high levels of occupational stress and 87.7% of GDPs to report symptoms suggestive of burnout; the highest proportions of any of the groups surveyed. In this survey, the threat of litigation and time-pressures are some of the factors cited as being common sources of stress for GDPs. Time pressure at work in particular has been shown to contribute to the development of Neuroticism as well as a reduction in Extraversion and Conscientiousness (Wu, 2016). As discussed earlier, no significant differences in Extraversion were seen between the groups, but the results do show GDPs to have lower levels of Conscientiousness and higher trait Neuroticism perhaps as a result of greater occupational stress.

Stress, Neuroticism, and job satisfaction are interrelated and the relationships between them are complex (Barlow et al., 2014, Judge et al., 2002b, Törnroos et al., 2019). Individuals higher in Neuroticism are likely to report lower levels of job and life satisfaction (Anglim et al., 2020, González Gutiérrez et al., 2005, Judge et al., 2002b). These individuals are also more likely to interpret experiences as stressful or threatening and have stronger or more prolonged negative affect in response to such experiences (Gunthert et al., 1999, Schneider, 2004). Stress has been shown to cause alterations in neural network structure and function and play a role in the development of higher levels of Neuroticism (Barlow et al., 2014).

One explanation for the higher levels of Neuroticism amongst GDPs relative to OMF surgeons, may be the existence of a relationship akin to a positive feedback loop whereby GDPs have objectively stressful roles, characterised by for example the unpredictable threat of litigation and substantial time-pressures, which predispose to higher trait Neuroticism, and this in turn results in a stronger perception of their jobs as being highly stressful (Wu, 2016). The equally high levels of Neuroticism seen in the dental nurses could in part be explained by the shared, stressful work environment of the general dental practice.

The mean Neuroticism scores for all groups were lower than the population average of 2.97. This is congruent with findings from Hoffman et al. (2010) who found a sample of medical students and registrars (qualified doctors undergoing further training) demonstrated higher levels of Stability (the inverse of Neuroticism) relative to the population. In contrast, Belsi et al. (2011) found Neuroticism scores to be similar to the UK population average in their sample of dental students, dental nursing students, and dental therapy students. The only exception were those dental students that had

already completed a medical degree and were subsequently undergoing dental training. They had a Neuroticism score marginally lower than population norms and this was significantly lower than the dental nursing student group, which mirrors our findings in the equivalent qualified professionals.

On balance, the findings of the present study and others outlined here and in the earlier review of the literature, suggest those in dental occupations, and healthcare more generally, tend to have lower levels of Neuroticism. It is difficult to deduce whether this reflects a survivorship bias, self-selection, or some other influential factor, but the evidence strongly suggests higher Neuroticism is associated with poor occupational outcomes and so lower levels of this trait are beneficial (Bria et al., 2012).

Neuroticism subsumes the facets of Anxiety and Depression. Anxiety is defined as the tendency to attend to negative experiences, and report negative emotions such as fears, worries, and anxiety across many situations (McCrae and Costa, 2003). Dental nurses had the highest mean Anxiety score, closely followed by GDPs, then orthodontists, with OMF surgeons having the lowest score. Both GDPs and orthodontists were found to have anxiety scores that were significantly higher than OMF surgeons ($p < 0.001$ and $p = 0.003$ respectively). This may again reflect the tendency for individuals lower in Neuroticism to self-select into high-stakes surgical careers.

Trait Depression can be characterised as a tendency towards feeling dejected, negativistic and being overly self-critical without valid justification (Klein et al., 2011). Dental nurses had the highest mean depression scores, followed by GDPs, then OMF surgeons, with orthodontists having the lowest scores. The mean score for dental nurses was significantly higher than that for orthodontists ($p < 0.001$). The difference

may be explained by the gender breakdown of each group with dental nurses being almost entirely female and orthodontists having an approximately even split. Costa Jr et al. (2001) found higher levels of trait depression in females across cultures and prior research has found there to be a higher prevalence of clinical depression in females. Although trait Depression and clinical depression are distinct there is an accepted relationship between the two (Klein et al., 2011), and these findings support the explanation of the difference between occupations arising from differences in gender ratios.

5.3.5 Openness, Aesthetics, and Ideas

Theorists have long debated how Openness should be defined (Connelly et al., 2014). It is the factor that is least consistent in cross-cultural replication studies investigating the FFM (Digman, 1990). Individuals high in Openness tend to be intellectually curious, imaginative, explore their inner feelings, and have strong aesthetic sensibilities. This is in contrast with those who prefer routine, tradition, and regularity (McCrae and Sutin, 2009). Whereas the other Big Five factors appear to be independent of intelligence and cognitive ability, Openness has relatively strong theoretical and empirical ties to intelligence (DeYoung et al., 2014). Openness also appears to play a role in shaping political attitudes, approaches to religiosity/spirituality, and tendencies towards being creative and pursuing innovation (Connelly et al., 2014). That final feature may make it a valuable trait which recruiters wish to seek out. Like the other factors Openness has been linked to certain vocational interests. Using Holland's taxonomy (1997), Openness has consistent and sizeable associations with Artistic and Investigative occupational interests (Connelly et al., 2014).

OMF surgeons had the highest mean Openness score, followed by orthodontists, then GDPs, and finally dental nurses. None of the differences between groups were statistically significant and the scores for all occupations were very similar to the UK population average of 3.67 ± 0.64 (Rentfrow et al., 2015). These findings suggest that high or low Openness is not a necessary attribute for working in any of the four professions studied and that working in any of them permits levels of the trait seen in the population on average.

This is consistent with Woods et al. (2016) who found little differences in the Openness scores of medics in different medical specialties. They reasoned that as all medical specialties are likely to have a substantial Investigative element they would all select for individuals high in Openness and so this homogeneity is likely to mean specialties do not differ on this trait. In contrast with their work, this present study also sampled dental nurses whose occupation had substantially lower Investigative RIASEC scores (Table 16). This would lead one to hypothesise that this group should have lower Openness scores and indeed dental nurses did have the lowest mean score of the four groups but the difference did not reach statistical significance.

Belsi et al. (2011) found dental nursing students to have significantly lower levels of Openness relative to graduate entry and medical graduate entry dental students. The validity of these findings may be impaired by a sample size of no greater than 19 for any of those groups in their study. Their findings however are consistent with the trend in our data which shows OMF surgeons to have the highest Openness and dental nurses the lowest.

Openness subsumes the lower order facets of Aesthetics and Ideas. Aesthetics or Aesthetic Sensitivity describes a tendency to be appreciative of artistic or natural

beauty and is related to creativity. Individuals high in this trait tend to create unique living and work spaces and report greater absorption in experiences with audio-visual or emotional underpinnings (Connelly et al., 2014, Rawlings et al., 2000). One would hypothesise that dentists, in particular orthodontists, would have higher Aesthetic Sensitivity given that both occupations treat conditions with the potential to compromise facial appearance. The mean scores do support this with orthodontists having the highest scores, then GDPs, and the remaining two having lower, and near identical, mean scores. Despite this, there were no statistically significant differences in Aesthetics between groups.

The facet of Ideas centres on the need for cognition, a motivational tendency to contemplate ideas, scrutinize information, and enjoy solving puzzles (Connelly et al., 2014). No statistically significant differences were found between the occupations for this trait reflecting the results for the broad trait domain of Openness.

The personality literature investigating healthcare and dental professionals has tended to focus on the Big Five without much attention paid to the narrower facets. This gives little scope to compare our findings for facets such as Aesthetics or Ideas with existing work. That said, our findings provide a basis upon which future research can be built and comparisons made.

5.4 Differences in Personality Based on Demographics

5.4.1 Participant Age

As shown in Table 8, there were significant correlations between age and the three factors of Conscientiousness, Neuroticism and Openness. In their review of the literature on mean level changes in personality traits across the lifespan Roberts et al. (2006) found Conscientiousness to increase and Neuroticism to decrease with age, reflecting the findings in our sample. In contrast, Agreeableness was shown to increase over the lifespan, but this was not seen amongst the participants in this study. Age was entered into the multiple regression analysis to account for its effect on personality traits and to help delineate the influence of occupation

5.4.2 Gender

A substantial body of research evidences the presence of gender differences in personality (Weisberg et al., 2011, Costa Jr et al., 2001, Feingold, 1994). These differences are modest in size, appear to be consistent with gender stereotypes, and replicate across cultures (Costa Jr et al., 2001). Women tend to be higher in negative affect, have a lower proclivity to be dominant, demonstrate greater nurturance, and appear to show greater concern for feelings rather than ideas (Costa Jr et al., 2001). It is worth emphasising that these generalisations are inferred from large samples from multiple and varied cultures but do not fully capture the personality of any single individual.

Females had significantly higher Agreeableness, Conscientiousness and Neuroticism relative to males ($p \leq 0.001$, $d = 0.25 - 0.48$). Males had Openness scores higher than females ($p < 0.001$, $d = 0.26$).

Effect sizes are given as Cohen's d with all values denoting a small to medium effect size, however these effect sizes are consistent with those found in the personality literature (Cohen, 2013, Robins et al., 2009, Weisberg et al., 2011, Goldberg et al., 1998, Feingold, 1994, Costa Jr et al., 2001).

The results from this analysis of the data, as well as the personality literature, suggested that the influence of gender should be accounted for when statistically evaluating the difference in personality between the different occupations in the dental team. To this end, gender was entered as an independent variable for the hierarchical multiple regressions for those personality traits where significant differences between occupations were found.

5.4.3 Ethnicity

Valid statistical analysis was impaired by the small sample sizes for some of the ethnic groups. Furthermore, where significant differences concerned the 'other' group, inferences are even less valid owing to the heterogenous nature of respondents in this category.

Existing literature has found differences between ethnicities living in the same multicultural societies (McCrae and Terracciano, 2005a, Goldberg et al., 1998, Brown et al., 2005), and other research has found there to be reliable differences in the mean levels of traits across cultures (McCrae and Terracciano, 2005a, McCrae, 2002). There is some evidence to suggest individuals from immigrant populations have personalities that more closely resemble the culture they have moved to, and these personalities conform to a greater degree the longer they have been resident there (McCrae et al., 1998). To account for this, participants were asked to provide information on past countries they lived in and for how long. There were a diverse

variety of responses, with many individuals having a unique and varied provenance. It would not be theoretically or statistically appropriate to group such heterogeneous backgrounds together and draw comparisons with those resident in the UK for life. There were also relatively similar proportions of non-lifetime UK residents in each of the professional groups (10-25% in each group). Consequently, ethnicity and cultural background were not entered as additional independent variables in the multivariate analysis of differences in personality by occupation.

5.4.4 Relationship Status

Statistically significant differences were found between the married and unmarried groups for the traits of Conscientiousness and Neuroticism with the $P\eta^2$ denoting small effect sizes Cohen (2013). With regards to Conscientiousness, married participants had a mean score 0.14 (95% CI 0.04 to 0.25) higher than those without ($p = 0.002$), and for Neuroticism, married participants had a mean score 0.25 lower (95% CI 0.10 to 0.39) ($p < 0.001$). No other statistically significant group differences were seen.

Previous research has found low Neuroticism, high Agreeableness, high Conscientiousness, and high Extraversion to predict relationship satisfaction (Malouff et al., 2010). Other meta-analytic work has confirmed associations between divorce and the converse of the aforementioned trait loadings with the exception of Extraversion (Roberts et al., 2007). This suggests a likely difference in personality between married and non-married individuals and results of this present study partly conform to the previous research in this area.

The literature suggests females in particular demonstrate higher levels of Conscientiousness and lower levels of Neuroticism if they are in stable relationships (Lehnart and Neyer, 2006, Robins et al., 2002, Scollon and Diener, 2006). When the

influence of partner status for each gender was considered in this present study, this sample conformed to those earlier findings. However, males were also seen to demonstrate higher levels of Conscientiousness if they were married. The size of these group differences were similar to those seen when the entire sample was analysed and not split by gender.

Research to date has tended to focus on personality differences between married and non-married individuals in particular, however some work in this area suggests differences between these groups is perhaps associated with all forms of stable, long-term relationship rather than marriage per se (Donnellan et al., 2004, Malouff et al., 2010, Schaffhuser et al., 2014). For this reason, after reviewing the responses to the question on marital status, a dichotomous distinction was made between partnered and non-partnered individuals. This dichotomous variable was then added to the hierarchical multiple regressions for Conscientiousness, Agreeableness and Neuroticism to determine whether this demographic variable was significantly associated with differences in each of those trait domains. As partner status did not contribute to the prediction of personality (non-significant change in R^2) it was excluded from each of the full hierarchical regression models.

5.4.5 Education

In a large representative sample of US working adults Goldberg et al. (1998) found years spent in education to moderately correlate with Openness. Interestingly, the correlation between years spent in education and Conscientiousness was comparatively weak. For this present sample, it is difficult to delineate the impact of time in education from that of professional role due to the nature of the training process for each role. For example, orthodontists in the UK must complete a higher academic

qualification as part of their specialty training, and maxillofacial surgeons must complete an undergraduate degree in both medicine and dentistry. This means when participants are grouped by their highest level of education, a sizeable proportion tended to fall into their occupational grouping.

5.4.6 Geographical Location

Research has found significant personality differences between and within nations, including the UK (Rentfrow et al., 2015, McCrae and Terracciano, 2005a). These differences are apparent in even smaller geographical confines such as within the city of London (Jokela et al., 2015). They are thought to be the result of selective migration, social influence and ecological influence (Rentfrow, 2020). Selective migration is where individuals select environments that suit their psychological needs, therefore individuals with similar psychological needs coalesce together in a shared environment. Social influence describes how the impact of a shared culture, unique to a geographical area, can influence those living there and mould their personalities. Finally, ecological influence refers to the empirical phenomenon where natural and man-made environments influence human psychology in a myriad of ways. An example is those individuals growing up in regions with clement temperatures demonstrating higher levels of Agreeableness, Conscientiousness, and Emotional Stability (Wei et al., 2017, White et al., 2013).

No significant differences were found between individuals living in different geographical areas when analysed with ANOVA. This may be explained by the relatively small sample compared to, for example, Rentfrow et al. (2015) who recruited 386,375 respondents in their study of geographical personality differences in Great Britain.

5.5 Personality and Job Satisfaction

There is evidence to suggest workers with personalities suited to their role demonstrate higher levels of job satisfaction (Holland, 1997, Törnroos et al., 2019). There is also much empirical support for a dispositional basis to job satisfaction which asserts that, much like in many other areas of life, job satisfaction is associated with temperament and personality (Heller et al., 2002, Judge et al., 2002b)..

To assess whether this latter assertion held true for the occupations in this present study, job satisfaction scores were obtained using a scale previously employed in an extensive UK personality survey (Rentfrow et al., 2015). Multivariate analysis was then used to determine whether any of the Big Five domains predicted job satisfaction.

Orthodontists and OMF surgeons had significantly higher job satisfaction scores compared to dental nurses and GDPs ($p < 0.001$) and these differences were moderate to large in size ($P\eta^2 = 0.118$).

The reason for these differences is likely multifactorial and will most probably include differences in the nature of day-to-day work, occupational stressors, and the personality profile of each group of professionals. The relationship between occupational stress and lower job satisfaction is well established and consistent across occupations (Cooper et al., 2001). The lower levels of job satisfaction seen in GDPs may be explained by the high levels of stress in this group (Collin et al., 2019). The fact that dental nurses often share the same stressful work environment of general dental practice could explain their similarly low levels of job satisfaction. No research has directly compared the levels of stress and job satisfaction amongst the four

occupations and so one cannot say to what extent differences in stress explain variance in job satisfaction.

When analysed using multiple regression, personality explained 12% of the variance in job satisfaction and the traits of Extraversion, Conscientiousness, Neuroticism, and Openness significantly added to the prediction (Table 13). From these, Neuroticism had the largest coefficient ($B = -.32$ 95% CI $-.41$ to $-.24$), meaning that a one unit increase in Neuroticism, as measured on a 1 to 5 Likert scale using the BFI, is associated with a job satisfaction score .32 lower, when it is also measured on a 5 point Likert scale. The results of the multiple regression analysis are consistent with the literature evidencing the role of disposition in determining job satisfaction (Judge et al., 2002b). Meta-analytic work found only the relationships with Neuroticism and Extraversion to generalize across studies and Neuroticism was found to be the strongest and most consistent correlate of job satisfaction; an observation mirrored by our results.

The two most statistically significant predictors of job satisfaction for our sample, Extraversion and low Neuroticism, are central to what has been termed the 'happy personality' and it seems evident that those with a tendency towards positive affect in life would have similar dispositions in their work (DeNeve and Cooper, 1998). All else being equal, they may interpret the characteristics of their jobs more positively than others. In addition, more extraverted workers, with greater degrees of emotional stability, as well as higher trait Conscientiousness are more likely to perform better at work (Barrick and Mount, 1991). Better performing employees are more likely to gain both intrinsic and extrinsic reward from their work and consequently report higher levels of job satisfaction.

One benefit of describing the personality of professionals currently working in the occupations studied here is to provide those seeking to enter such professions insight into whether their personality would match through comparison of scores attained on a similar psychometric inventory. This is in keeping the body of research which holds occupation-person fit to be key in job satisfaction (Holland, 1997).

These findings are also of particular relevance to recruiters. Identifying applicants higher in Extraversion and Conscientiousness as well as lower in Neuroticism may lead to the selection of better performing and happier staff. The dental team may stand to benefit if such new appointees are brought in as low Neuroticism has been shown to correlate with greater satisfaction from team work, and similarities in trait Conscientiousness and Extraversion between team members is also correlated with better team dynamics (Peeters et al., 2006).

5.6 Strengths and Limitations

5.6.1 Sample Size

This study benefits from the large sample obtained; a considerable achievement given how restrictions imposed in response to the Covid-19 pandemic limited in-person data collection. The highly successful use of social media in recruiting adequate participants was also central to making the study possible.

The sample size was in excess of that deemed necessary by the power calculation and in other circumstances may lead to the criticism of increasing the likelihood of Type I error. Although this may be a valid concern in other avenues of research it is less relevant in personality psychology where many investigations are found to be underpowered (Fraleigh and Vazire, 2014). The risk of Type I errors must also be

considered in the context of the credibility of the null hypothesis in this area of research. The null hypothesis is almost always false in personality research as in the real world there is virtually always a non-zero correlation between psychological variables owing to complex, indirect causal effects (Fraley and Marks, 2007). This says nothing about the importance or lack thereof of such correlations, but simply that they exist. The threat of a Type I error may therefore be overstated and of greater concern is insufficient sample size and power, the sampling error associated with smaller samples, and the potential for Type II errors (Fraley and Marks, 2007, Fraley and Vazire, 2014)

Furthermore, previous work aiming to identify individual differences in personality, albeit on a far more granular level, has used samples in excess of 300,000 participants (Rentfrow et al., 2015), and the literature is replete with studies with samples far in excess of that in the present study (Feingold, 1994, DeNeve and Cooper, 1998, Judge et al., 2002b, Barrick et al., 2003, Roberts et al., 2006, Vukasović and Bratko, 2015).

Finally, In an effort to address issues raised about the apparent lack of replicability of findings in behavioural science, Soto (2019) conducted preregistered, high-powered replications (median $N = 1,504$) of 78 previously published personality trait–outcome associations. The median sample size of the replication studies was intentionally increased in excess of the originals in an effort to improve power and reduce the likelihood of Type II errors, again highlighting the necessity of adequately large sample sizes in the field of personality research.

5.6.2 The Validity of the BFI and the FFM

In keeping with recommendations from the review of the literature performed by Borges and Savickas (2002), the psychometric test used, the BFI, had previously

demonstrated validity and reliability and was based on the prevailing and empirically supported FFM (John et al., 2008a). This afforded comparison between groups on the Big Five, as well as more granular personality facets subsumed by these higher order domains. This sets our work apart from previous research which has often utilised less empirically robust psychometric tests such as the MBTI (Borges and Savickas, 2002).

5.6.3 Accounting for Confounding Demographic Variables

The relationships between personality and demographic variables is well-established (Feingold, 1994, Goldberg et al., 1998, Costa Jr et al., 2001). Prior research on personality differences between groups of healthcare professionals has been inconsistent in its attempts to account for these associations (Smithers et al., 2004, Chamberlain et al., 2005, Belsi et al., 2011). This is particularly problematic when one considers the differences in demographics between the occupations studied here (see Tables 3 and 4). Hierarchical multiple regression was applied to control for the confounders of age and gender and better elucidate associations between occupation and personality.

5.6.4 Sampling Bias

Logistical constraints will likely have led to some degree of sampling bias. We utilised multiple avenues of recruitment including social media, the mailing lists of dental schools, and the membership of professional societies such as the British Orthodontic Society. Our sample of each of the four occupations may not be representative and so generalisability may be impaired. Previous research has found samples recruited via the internet are not representative of the general population (Gosling et al., 2004), but the extent to which this applies to online samples of healthcare professionals is unknown. Using the multiple avenues of recruitment mentioned earlier, may have

tempered the bias from any single approach, but the study would have benefited from the addition of in-person recruitment; an approach that was planned but made unfeasible by the Covid-19 pandemic.

Data from the GDC and research by Magennis et al. (2020) allowed for comparison between our sample and the total population of each of the four occupations (General_Dental_Council, 2020). Female GDPs and OMF surgeons were over-represented in our sample, whereas the gender ratio of dental nurses and orthodontists was approximately representative. Given the known associations between gender and personality, this may have introduced bias, although an attempt was made to account for this in the analysis.

5.6.5 Non-response Bias

It is virtually impossible to get an accurate estimate of response rate given how social media was used in order to recruit participants. Omitting the use of social media or using it in a more constrained manner would have allowed for a better estimate of the response rate, and consequently a better appreciation of the extent of non-response bias, but would almost certainly have resulted in an inadequate sample size.

Supporting information and a link to the survey were posted on professional Facebook pages and Twitter. Though it is possible to know the number of members in a Facebook group, one cannot determine how many are active or how many saw the study information. This is more challenging still with Twitter where a post is made and shared (retweeted) in an even more unpredictable and fluid manner. Consequently, one cannot be certain of the response rate or any systematic way in which participants differed from non-responders.

5.6.6 The Self-report Method

This study used a self-report psychometric test to measure the personality of participants. This method has associated biases which may interfere with the validity of responses (Paulhus, 1991). Socially desirable responding (SDR) occurs when individuals respond in a manner which reflects an inaccurate and overly positive self-description. With samples such as the one in this study, SDR is unlikely to be an issue as the anonymity of responses is stressed, the survey is completed without direct involvement from the research team, and the participants stand to gain nothing from presenting themselves in a socially desirable way (Paulhus and Vazire, 2007).

One can be more confident about the results of a psychometric test if it shows convergence with other self-report inventories and other methods of personality research. The BFI has established validity, reliability and convergence with other widely used personality inventories, as well as other methods of measuring personality (John et al., 2008a, Soto and John, 2009). This provides some confidence that our measurements of the personality of participants are likely to be valid.

5.6.7 Controlling for Acquiescent Responding

Acquiescent responding (AR) is the tendency to consistently agree or disagree with items in an inventory regardless of their content and it may be a manifestation of respondent fatigue or apathy. Such responding poses a significant threat to validity especially for scales such as the BFI where there is an unequal number of true- and false-keyed items (Soto et al., 2008, Paulhus and Vazire, 2007). In accordance with the recommendations of the authors of the BFI, AR was controlled for via within-person centering. 16 pairs of BFI items with opposite implications for personality were used to compute what is termed 'the BFI acquiescence index'. This index is the mean

response to this set of 32 items and an individual's score on the index is subtracted from each of their responses to the 44-item BFI, thereby controlling for AR. The full 44 items were not used as there is an unequal number of true- and false-keyed items in the inventory.

Following this, and in accordance with previously published work by Soto and John (2009), items from the BFI were used to compute scores for the Big Five as well as 10 lower order facets. The authors of the BFI were contacted for, and kindly provided, a copy of the SPSS syntax used to both centre responses for AR and derive data on personality at the Big Five and facet level.

Correlations between centred and non-centred Big Five scores were near perfect with none lower than .974. Correlations between facet scores calculated using centred and non-centred responses were also very high with none being lower than .970. In light of this evidence for very limited contamination of the data through AR, the non-centred Big Five and facet scores were used in the analyses of group differences.

5.6.8 Drawing Comparisons with Normative Data

To contextualise the *size* of the differences seen between the groups in this study comparisons were made with the most appropriate normative data set available in the literature (Rentfrow et al., 2015). This was to allow for better determination of how the four occupational groups may be unique in terms of their personality relative to the general population and to provide context for the cross-sectional snapshot achieved in this study.

Using norms in the interpretation of psychometric data is problematic. Norms are typically established through large observational studies which employ convenience

sampling (Allik et al., 2017, McCrae, 2002). There is no reason to assume the norms from a such studies represent the “average” population a researcher is attempted to compare their sample to. Comparison between a study sample and these norms is therefore unlikely to be perfect.

5.7 Implications of this Research

The results of this study, derived from a large sample, provide a contemporary personality profile of the four occupations. Recruiters may wish to draw comparison between the personalities of applicants and those of incumbents. That said, there is substantial inter-individual variation in each occupation and any such psychometric testing should form but a part of the recruitment process.

For the individual, one must accept that a great deal of personality is intrinsic, genetically determined, and influenced by ones experiences to date (Costa et al., 2000, Costa Jr and McCrae, 1994). That said, abundant evidence shows there to be change in personality across the lifespan (Roberts et al., 2006, Roberts and Mroczek, 2008). Some of this is ‘maturational’ whereby a majority of individuals demonstrate a natural tendency towards becoming more self-confident, warm, and emotionally stable, especially as they move through the third and fourth decades of life. This has positive implications for their work life as such attributes are likely to result in better outcomes in almost all occupations.

In addition, what one chooses to invest their time and effort into influences their personality and as individuals take on greater responsibility and leadership as they progress through their careers they are likely to develop traits consistent with these obligations (Li et al., 2021, Lodi-Smith and Roberts, 2007). Finally, the relationship

between personality and environment, including occupation, is reciprocal and personality will influence what occupations individuals choose to enter as well as how the occupation will mould them (Turkheimer and Waldron, 2000, Heller et al., 2002, Woods et al., 2020, Wille and De Fruyt, 2014).

Decades of research into vocational choice has demonstrated the value in finding occupations that fit one's personality (Holland, 1997, Heller et al., 2002, Donohue, 2006) and this study provides valuable insight into the mean personality profiles of the four occupations studied, both at the level of the Big Five domains, but also at the more granular facet level; a level of detail not represented by the existing research on the personality of dental professionals.

Contemporary research has begun to elucidate the potential for occupations to influence personality (Wu, 2016, Woods et al., 2019, Li et al., 2021), and future, longitudinal work may uncover how membership of the occupations studied here may differentially change personality over time.

6 Conclusion

There are statistically significant differences in Agreeableness, Conscientiousness and Neuroticism between the four occupations. The size of these differences is small to medium but consistent with sizes seen in the personality literature, and of sufficient magnitude to influence important consequential outcomes (Roberts et al., 2007).

These differences could be explained in part by the differences in demographic variables between groups, however occupation is associated with personality even after accounting for the demographic variables of age and gender. Associations between personality and demographic variables in this sample are also consistent with those in the literature.

The personality profile of the occupations is largely consistent with what would be expected based on their RIASEC categorisation.

Personality also predicted job satisfaction with Neuroticism in particular being strongly associated with lower levels of job satisfaction.

The results from this investigation provide a personality profile of the four occupations in the UK and may be of value to both recruiters and applicants.

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8 Appendix 1 – Statement of Ethical Approval

Dear Naeem

DREC ref: 180620/NA/300

Study title: Personality Traits in the Dental Team (a cross-sectional survey of personality traits of UK dental professionals)

Thank you for submitting the amended documents for the above application to the Dental Research Ethics Committee (DREC). The documents have been reviewed and I am pleased to inform you that the application has been approved.

Documents reviewed

Document name	Version number and date
Ethics application	Dated 06/10/2020
Protocol	Version 1 01/10/2020
Email to participants	Version 1 01/10/2020
Social media post	Version 1 01/10/2020
Survey	Version 1 01/10/2020
Survey introduction and exit page	Version 1 01/10/2020
Recruitment methods	Version 1 01/10/2020

With best wishes for the success of your project.

For and on behalf of
 Professor David Wood
 DREC Chair

9 Appendix 2 – Job Satisfaction Questions

Select the extent to which you agree with the following statements about your job satisfaction:

	Disagree strongly	Disagree somewhat	Neither agree nor disagree	Agree somewhat	Agree strongly
I like my job better than the average person does.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am seldom bored with my job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Most days I am enthusiastic about my job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am fairly well satisfied with my job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I find real enjoyment in my job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10 Appendix 3 – Factor Analysis with Varimax Rotation

Rotated Component Matrix

Item Number	E	N	A	O	C
21r	.839				
31r	.798	-.132			
6r	.789	-.101			
1	.732		.126		
36	.694	-.110			
26	.471	-.238	-.309	.234	.247
9r		.742	-.215	-.158	
24r		.720			-.101
19	-.130	.709			
34r		.626	-.169	-.226	
39	-.379	.613			
4	-.147	.570	-.131		-.106
14		.548	-.424		
37r			.720		.136
27r	.270		.677		.198
2r		-.176	.600		
32			.571	.136	
17		-.126	.559	.116	
12r	-.233		.553		.210
29	-.114	.326	-.535		-.226
42	.100		.409	.142	.140
25		-.186		.735	
5	.241	-.104		.706	.136
15	-.142			.648	
40				.641	.156
20		.153		.620	-.138
10		-.138		.548	
18r					.688
23r	.132		.174	.124	.642
43r		-.238	.114		.641
8r			.217		.640
33		-.146		.104	.487
38	.202	-.142			.478
28				.192	.452

7			.269	.123	
3					.350
13					.340
44				.249	
30			.105	.352	
35r		-.152		.219	
41r					
22			.357		
11	.258	-.275		.228	
16	.409	-.108	.165	.392	

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

r = reverse keyed item

Rotation converged in 10 iterations.

E, N, A, O, C = Extraversion, Neuroticism, Agreeableness, Openness, Conscientiousness