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ORIGINAL ARTICLE

Dissecting the surgeon's personality: cross-cultural comparisons in Western Europe

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Abstract

Aim: The surgeon's personality contributes to variation in surgical decision-making. Previous work on surgeon personality has largely been reserved to Anglo-Saxon studies, with limited international comparisons. In this work we built upon recent work on gastrointestinal surgeon personality and aimed to detect international variations.

Method: Gastrointestinal surgeons from the UK and the Netherlands were invited to participate in validated personality assessments (44-item, 60-item Big Five Inventory; BFI). These encompass personality using five domains (open-mindedness, conscientiousness, extraversion, agreeableness and negative emotionality) with three subtraits each. Mean differences in domain factors were calculated between surgeon and nonsurgeon populations from normative data using independent-samples *t*-tests, adjusted for multiple testing. The items from the 44-item and 60-item BFI were compared between UK and Dutch surgeons and classified accordingly: identical ($n = 16$), analogous ($n = 3$), comparable ($n = 12$).

Results: UK ($n = 78$, 61.5% male) and Dutch ($n = 280$, 65% male) gastrointestinal surgeons had marked differences in the domains of open-mindedness, extraversion and agreeableness compared with national normative datasets. Moreover, although surgeons had similar levels of emotional stability, country of work influenced differences in specific BFI items. For example, Netherlands-based surgeons scored highly on questions related to sociability and organization versus UK-based surgeons who scored highly on creative imagination ($p < 0.0001$).

Conclusion: In a first cross-cultural setting, we identified country-specific personality differences in gastrointestinal surgeon cohorts across domain and facet levels. Given the variation between Dutch and UK surgeons, understanding country-specific data could be useful in guiding personality research in healthcare. Furthermore, we advocate that future work adopts consensus usage of the five factor model.

KEYWORDS
Big Five, five-factor model, surgeon personality, surgical personality

V. Q. Sier and C. N. Bisset contributed equally to this work.

SUPER and Plato Project Collaborators are presented in Appendix A.

INTRODUCTION

When compared with the general population and other medical professions, surgeons appear to possess different personality traits [1–3]. This may be related to aspects such as conscientiousness (associated with diligence and perseverance) and emotional stability (associated with remaining calm under pressure) [1]. To develop surgeons' technical and nontechnical skills, it is crucial to consider personality factors that affect teamwork and decision-making. The significance of surgeon personality traits in surgical decision-making has recently been established in gastrointestinal surgery [4]. Patients have also indicated their preferences, considering surgeons with low levels of conscientiousness and emotional stability to be potential 'risk factors' for adverse postoperative outcomes [5]. Similarly, in orthopaedic and cardiac surgery, personality has been shown to influence operative recommendations and patient outcomes [6, 7], although previous work has often been limited to single-country cohorts. With personality varying across cultures and environments, we developed an interest in comparing surgeons across countries with different healthcare systems and hospital cultures, yet similar standards of care. For rectal cancer patients, this is of particular importance due to the recognized link between surgeon personality and variations in anastomotic decision-making [4, 8].

Previous work on surgeon personality has largely focused on determining a 'profile' of physicians versus surgeons versus the general population [9, 10]. Classically, the five-factor model ('the Big Five') taxonomy is employed; this identifies five domains that comprise personality, namely open-mindedness, conscientiousness, extraversion, agreeableness and neuroticism/negative emotionality (the inverse of emotional stability), with each considered to be on a spectrum (Figure 1). At the time of writing, surgeon personality research has relied on pooled results with no clear direct international comparisons nor interspeciality variations, whereas factors such as culture, social context and geographical location are known to influence personality [4, 9, 11]. In addition, environmental differences may play a role in the (self-)selection of individuals, encompassing personal factors such as the pathway to becoming a surgeon and interpersonal interactions, as well as external elements like the operational framework, scope of work and institutional policies. The interplay of these factors introduces unique challenges for medical professionals in different countries and may influence variation in surgeon personality and decision-making.

The primary aim of this collaborative study was to assess potential differences in surgeon personality on an international scale. Our secondary aim was to explore a novel approach to facilitate (surgical) personality comparisons across cohorts that completed different iterations of established five-factor models.

What does this paper add to the literature?

This is the first study to explore international variations in gastrointestinal surgeon personality using the full-form Big Five Inventory instrument. Given the recognized link between surgeon personality and clinically relevant decision making, we provide the first foundation for understanding of cross-cultural differences in surgeon personality traits.

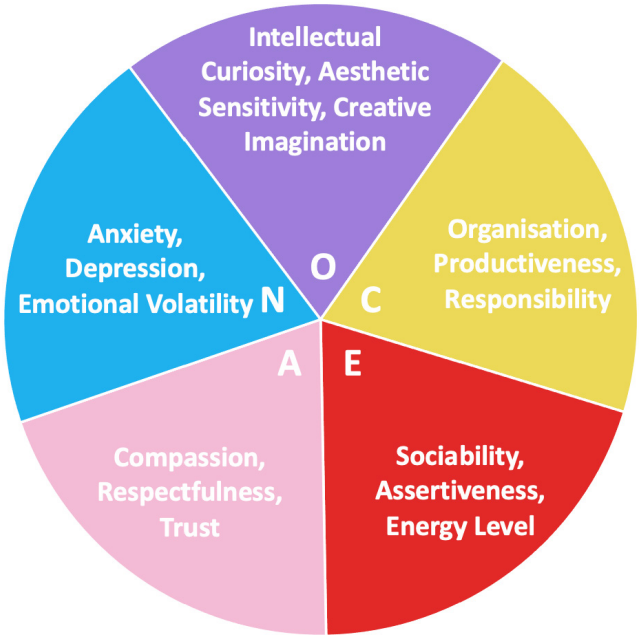

FIGURE 1 Five factor model ('the Big Five') domains with subordinate facets according to the Big Five Inventory model: A, agreeableness; C, conscientiousness; E, extraversion; N, negative emotionality; O, open-mindedness.

METHOD

Data collection

This was a two-country international pooled cross-sectional study into the personality of gastrointestinal surgeons from the Netherlands and the United Kingdom (UK). Survey results are reported following the CHERRIES framework (Checklist for Reporting Results of Internet E-Surveys) [12]. Surgeons from both countries were invited to voluntarily complete the different iterations of the Big Five Inventory (BFI). In general, no exclusion criteria were introduced, although recruitment and inclusion were multimodal and differed for both countries. In the UK, data were employed from the Plato Project [4]. Fully certified colorectal surgeons (i.e. consultants), capable of making an independent anastomotic decision, were approached either via email invitations from professional bodies (e.g. the Association of Coloproctology of Great Britain and Ireland) or social media to complete the BFI between 14 August 2020 and 5 November 2022. Since gastrointestinal surgery is a subspeciality of general surgery in the Netherlands, the BFI-2 was distributed per email as an open, voluntary, digital survey amongst all hospitals across the country via members of the Surgical Personality Consortium between 21 June 2021 and 16 May 2023. No incentives were offered to the participants, possibilities for review were provided and unique visitors were identified via cookies. Informed consent

included informing the participants on the length of time needed to complete the survey, the type of data stored, data storage and the purpose of the study. After two reminders, the data were finalized and filtered for surgeons with a gastrointestinal subspeciality status for inclusion in the current study.

Measures

The BFI family consists of hierarchical measures of the five factor model of personality that have been validated in multiple languages and/or cultures (Figure 1). This model divides personality into five broad domains: conscientiousness, extraversion, openness to experience, agreeableness and neuroticism (inverse of emotional stability) (Table 1). The first rendition, the 44-item BFI [13, 14], uses 44 short phrases that are answered on a Likert scale (1–5; strongly disagree–strongly agree). The second rendition, the 60-item BFI-2, uses a similar short phrase structure as the original BFI but includes additional phrases to achieve equal computation of the Big Five domains and encompasses multiple textual adaptations to several items [15, 16]. As a result of these developments, similar and/or identical items are shared between the items that constitute the facets and domains of BFI and BFI-2. Furthermore, large validation studies of the BFI allow comparison of personality traits of the general population per country and/or region [17].

Normative data

In addition to the surgical populations, both UK and Dutch normative population personality datasets were used. The UK data were retrieved from a large internet-based survey designed and administered by the University of Cambridge in collaboration with the British Broadcasting Corporation (BBC) [18]. Between November 2009 and April 2011, 588 014 individuals completed the BFI, with invitations spread through BBC websites, television programmes and radio shows. The Dutch dataset was acquired from the Longitudinal Internet Studies for the Social Sciences (LISS) panel. The LISS panel is a representative sample of Dutch individuals who participate in monthly internet surveys. The panel is based on a true probability sample of households drawn from the population register. Households that could not otherwise participate are provided with a computer and internet connection. A longitudinal survey is fielded in the panel every year, covering a large variety of domains (e.g. health, work, education, income, housing, time use, political views, values and personality). For our study, the BFI-2 LISS dataset, as originally requested by Denissen et al [16] (https://osf.io/nwtx7/), was transformed to use as a normative population dataset. The dataset consisted of 824 respondents, of which we included all those aged 36–67 years ($n = 432$) to match the range of the surgical workforce.

Ethics

Ethical approval was obtained from the University of Aberdeen College Ethics Review Board (CERB/2020/4/1984) with consent for subgroup analysis; the regional Dutch Medical Ethics Assessment Committee (Leiden, Den Haag, Delft) decided that this study is not subject to the Medical Research Involving Human Subjects Act (WMO). The corresponding scientific and non-WMO committee within the Leiden University Medical Centre (LUMC) gave their respective approval and nonobjection. Research data were stored according to the LUMC data management guidelines.

Analysis and statistics

To ensure comparability of data acquired via the BFI and BFI-2, an individual item approach was chosen in which all overlapping items between both measures were categorized in one of the following groups: (i) identical ($n = 16$), (ii) analogous ($n = 3$), (iii) comparable ($n = 12$) (Figure 2). Notably, for the analogous group, some textual adaptations were introduced to the Dutch BFI-2, while these items remained identical in the English versions of the BFI and BFI-2. Between the Dutch versions of the BFI and BFI-2, some items were textually altered within the different iterations,

TABLE 1 Short definitions of the Big Five domains (derived from John and Srivastava 1999 [14]).

Open-mindedness	Describes the breadth, depth, originality and complexity of an individual's mental and experiential life
Conscientiousness	Describes socially prescribed impulse control that facilitates task- and goal-directed behaviour, such as thinking before acting, delaying gratification, following norms and rules, and planning, organizing and prioritizing tasks
Extraversion	Implies an energetic approach toward the social and material world and includes traits such as sociability, activity, assertiveness and positive emotionality
Agreeableness	Contrasts a prosocial and communal orientation toward others with antagonism and includes traits such as altruism, tender-mindedness, trust and modesty
Negative emotionality	Contrasts emotional stability and even-temperedness such as feeling anxious, nervous, sad and tense

although these items are identical in the English versions. These items have been incorporated in the analogous category. Items that were rephrased in all BFI-2 translations were classified as comparable (Figure 2). Incomplete personality questionnaires were not analysed.

Independent-samples *t*-tests were employed to compare average item scores between UK and Dutch surgeons. Bonferroni correction for multiple testing was used. Statistical Package for the Social Sciences (SPPS, version 25; IBM SPSS Inc., Armonk, NY) software was employed for statistical analyses.

RESULTS

Respondents

In total, 280 Dutch gastrointestinal and 78 UK colorectal surgeons completed the Big Five personality assessment (Table 2). Age ranges were categorized in cohorts of 10 years. A similar distribution was observed in both UK and Dutch surgeon groups, although a higher percentage was found in the older age ranges (40 to ≥60 years) in the Dutch cohort. In terms of gender, 38.5% of UK and 34.6% of Dutch surgeons identified as female. Moreover, the Dutch gastrointestinal surgeons had increased working experience in independent surgical practice relative to the UK cohort (Table 2).

Normative comparisons

To contextualize the personality profile of both surgeon groups, comparisons were made with normative data (Table 3).

Considering the apparent differences in general populations, distinct personality profiles were observed in both surgeon cohorts relative to their respective norm. In comparison with the corresponding general population, UK-based surgeons scored as less open-minded and the Dutch surgeons as more open-minded (Δ: −0.553, 0.382; Table 3). Similar differences were observed for conscientiousness and extraversion, with Dutch surgeons scoring higher (Δ: 0.421, 0.410) and UK surgeons lower (Δ: −0.475, −0.455) relative

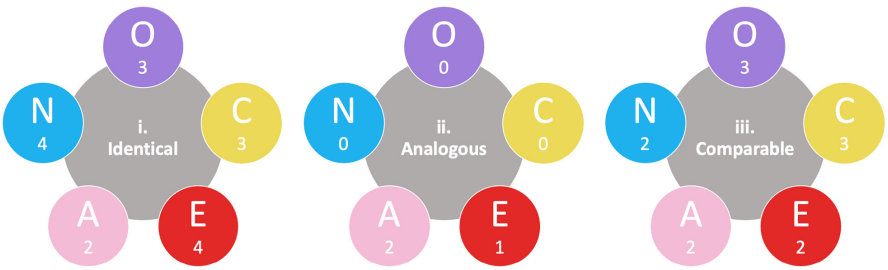

FIGURE 2 Number of overlapping items between the BFI and BFI-2, as categorized per degree of similarity: (i) identical, (ii) analogous, (iii) comparable.

TABLE 2 Respondent characteristics (baseline) of Dutch and UK normative datasets and gastrointestinal surgeons.

	Dutch normative population, 36–67 years	Dutch surgeons	UK normative population, 36–67 years	UK surgeons
Responses (*n*)	432	280	173 008	78
Age range, *n* (%)				
30–39 years	55 (12.7%)	36 (12.8%)	35 754 (20.6%)	14 (17.9%)
40–49 years	119 (27.5%)	114 (40.7%)	73 391 (42.4%)	41 (52.6%)
50–59 years	147 (34.0%)	91 (32.5%)	44 217 (25.6%)	20 (25.6%)
≥60 years	111 (25.7%)	39 (13.9%)	19 646 (11.4%)	3 (3.8%)
Gender, *n* (%)				
Female	225 (52.1%)	97 (34.6%)	111 763 (64.6%)	30 (38.5%)
Male	207 (47.9%)	183 (65.4%)	61 245 (35.4%)	48 (61.5%)
Nonbinary	–	–	–	–
Independent working experience as surgeon, *n* (%)				
<5 years	–	49 (17.5%)	–	27 (34.6%)
5–9 years		52 (18.6%)		19 (24.6%)
10–14 years		58 (20.7%)		17 (21.8%)
15–20 years		50 (17.8%)		7 (8.9%)
>20 years		71 (25.4%)		8 (10.3%)

to the normative population. For agreeableness, colorectal surgeons from the UK possessed lower levels relative to the normative population (−0.760), whereas Dutch surgeons had higher scores on average (0.178). Considering negative emotionality, both UK (−0.128) and Dutch surgeons (−0.485) demonstrated lower levels than the general population (Table 3).

Item-level comparisons between UK-based and Dutch gastrointestinal surgeons

At the item-level, direct comparisons between the surgeon cohorts in both countries revealed differences across all personality domains. To structurally compare the average scores on the individual items of the BFI and BFI-2 between the UK and Dutch gastrointestinal surgeon groups, overlapping items were analysed in three categories: (i) identical ($n=16$), (ii) analogous ($n=3$), (iii) comparable (Figure 2, Tables 4–6).

Identical items

All identical shared items between the 44-item BFI and the 60-item BFI-2 were compared between the Dutch and UK surgeon cohorts (Table 4). Notably, a couple of item differences will be highlighted. Within the open-mindedness domain, UK surgeons demonstrated higher average overall scores on the creative imagination item (4.420) than Dutch gastrointestinal surgeons (3.840) ($p<0.001$, Table 4). Furthermore, Dutch surgeons had higher mean scores on conscientiousness items. For instance, UK surgeons averaged at 2.763 on the reversed item 'tends to be lazy', while Dutch surgeons scored 4.221 ($p<0.001$). On average, a higher score was

TABLE 3 Big Five domain scores of UK and Dutch gastrointestinal surgeons relative to normative populations.

Domain	UK surgeons (SE)	UK normative (SE)	UK Δ	Dutch surgeons (SE)	Dutch normative (SE)	Dutch Δ
O	3.109 (0.037)	3.662 (0.002)	−0.553	3.859 (0.030)	3.447 (0.029)	0.382
C	3.335 (0.048)	3.810 (0.002)	−0.475	4.187 (0.025)	3.766 (0.026)	0.421
E	2.776 (0.031)	3.231 (0.002)	−0.455	3.784 (0.030)	3.374 (0.029)	0.410
A	3.029 (0.023)	3.789 (0.002)	−0.760	4.101 (0.024)	3.923 (0.022)	0.178
N	2.763 (0.035)	2.891 (0.002)	−0.128	2.057 (0.030)	2.542 (0.029)	−0.485

Abbreviations: A, agreeableness; C, conscientiousness; E, extraversion; N, negative emotionality; O, open-mindedness.

TABLE 4 Identical item average scores for UK and Dutch gastrointestinal surgeons.

Domain	Facet	Question (BFI = BFI-2) (I see myself as someone who…/I am someone who…)	UK score (SE)	Dutch score (SE)	*p*-value
O	Intellectual curiosity	Is curious about many different things	2.190 (0.113)	4.180 (0.042)	<0.001
	Aesthetic sensitivity	Has few artistic interests (R)	3.040 (0.113)	3.739 (0.063)	<0.001
	Creative imagination	Is original, comes up with new ideas	4.420 (0.074)	3.840 (0.049)	<0.001
C	Organization	Tends to be disorganized (R)	1.935 (0.098)	4.104 (0.050)	<0.001
	Productiveness	Tends to be lazy (R)	2.763 (0.121)	4.221 (0.050)	<0.001
	Responsibility	Can be somewhat careless (R)	3.590 (0.127)	4.029 (0.050)	<0.001
E	Sociability	Is talkative	2.280 (0.109)	3.700 (0.049)	<0.001
		Tends to be quiet (R)	2.064 (0.084)	3.736 (0.054)	<0.001
		Is outgoing, sociable	3.460 (0.125)	4.000 (0.049)	<0.001
	Assertiveness	–	–	–	–
	Energy level	Is full of energy	1.870 (0.091)	4.080 (0.038)	<0.001
A	Compassion	Is helpful and unselfish with others	2.190 (0.111)	3.960 (0.041)	<0.001
	Respectfulness	–	–	–	–
	Trust	Has a forgiving nature	2.550 (0.135)	3.860 (0.045)	<0.001
N	Anxiety	Is relaxed, handles stress well (R)	2.820 (0.111)	2.004 (0.044)	<0.001
		Can be tense	3.140 (0.116)	2.760 (0.060)	0.003
		Worries a lot	2.230 (0.119)	2.420 (0.056)	0.128
	Depression	–	–	–	–
	Emotional volatility	Is emotionally stable, not easily upset (R)	2.779 (0.138)	1.779 (0.043)	<0.001

Abbreviations: A, agreeableness; C, conscientiousness; E, extraversion; N, negative emotionality; O, open-mindedness; R, reversed.

TABLE 5 Analogous item average scores for UK and Dutch gastrointestinal surgeons[a].

Domain	Facet	BFI item	BFI-2 item	UK score (SE)	Dutch score (SE)	*p*-value
E	Sociability	–	–	–	–	–
	Assertiveness	Has an assertive personality	Has an assertive personality	3.610 (0.096)	3.771 (0.048)	0.124
	Energy level	–	–	–	–	–
A	Compassion	–	–	–	–	–
	Respectfulness	Is sometimes rude to others (R)	Is sometimes rude to others (R)	2.325 (0.089)	3.921 (0.055)	<0.001
	Trust	Tends to find fault with others (R)	Tends to find fault with others (R)	2.782 (0.123)	4.053 (0.043)	<0.001

Abbreviation: A, agreeableness; E, extraversion; R, reversed.

[a]Within the analogous group, items from the Dutch BFI and BFI-2 differ textually. Items from the English BFI and BFI-2 are identical.

observed in the Dutch surgeon cohort on items in the extraversion domain (Figure 1). The UK group scored 1.870 on the item 'is full of energy', while Dutch surgeons scored 4.080 ($p < 0.001$). Concerning agreeableness, Dutch surgeons scored higher relative to their UK colleagues on the item 'Is helpful and unselfish with others', with scores of 3.960 and 2.190 ($p < 0.001$), respectively. Regarding negative emotionality, similar scores were observed between both groups, although a lower average was identified for the reversed item 'Is emotionally stable, not easily upset' in the Dutch (2.779) compared with the UK surgeons (1.779) (Table 4, $p < 0.001$).

Analogous items

Three analogous items were identified between the BFI and BFI-2, which pertained to the extraversion and agreeableness domains (Figure 2). We observed significant differences within the items of the latter, specifically in the respectfulness and trust facets (Table 5). More specifically, UK-based and Dutch surgeons, respectively, scored 2.325 and 3.921 on the reversed item 'Is sometimes rude to others' and 2.782 and 4.053 on the reversed item 'Tends to find fault with others' ($p < 0.001$, $p < 0.001$; Table 5).

Comparable items

Twelve items were classified as comparable across BFI and BFI-2 and average scores were compared between British and Dutch gastrointestinal surgeons. (Figure 2, Table 6).

Regarding open-mindedness, all three items differed significantly between both groups and in both directions. For instance, UK surgeons scored 4.270 on the item 'Values artistic, aesthetic experiences' and a score of 3.850 was observed in the Dutch group ($p < 0.001$). For the item 'Is ingenious, a deep thinker', UK surgeons scored 3.360 compared with 3.850 for the Dutch ($p < 0.001$). Considering conscientiousness, the items within the productiveness facet demonstrated higher average scores in the Dutch group ($p < 0.001$). Similarly, Dutch surgeons demonstrated a higher score of 4.280 on the item within the facet responsibility relative to 3.630 in the UK cohort (Table 6, $p < 0.001$). For extraversion, differences were observed, with the UK surgeons for instance scoring higher (4.040) relative to the Dutch group (3.268) on the reversed item within the sociability facet ($p < 0.001$). Regarding agreeableness, Dutch surgeons scored higher on both reversed items in the facets compassion and respectfulness ($p < 0.001$). Significantly different variances were observed for the item 'Can be moody', where Dutch surgeons scored significantly higher (1.620 vs. 1.960, $p < 0.001$).

DISCUSSION

This is the first international pooled study of surgeon personality, addressing the lack of cross-cultural comparisons and specific surgeon groups in the existing literature. While the Plato Project [4] and SUPER consortium [19] were initially discrete initiatives, collaboration and shared interest in further exploring surgeon personality may lead to an improvement in the quality of personality research within healthcare. Together we have further built upon recent work and detected interesting international variations in surgeon personality traits. While the Plato Project was an international study of surgeon personality, overall participant numbers per country were not sufficient to allow individual country analysis, emphasizing the importance of this collaborative work. In this present study, surgeons from both countries were different both when compared with their population norms and in direct comparison. In addition, an analysis framework of the 44-item and 60-item BFI iterations was introduced, allowing for item-level comparisons based on the degree of question similarity.

There is increasing interest in clarifying the intersection between surgeon personality and their clinical experiences; including operative decision-making [4, 8], patient outcomes [6, 7] and the surgeon's job satisfaction [20]. However, as most studies on surgeon personality have had small numbers of participants, occurred in single centres or countries (chiefly from the UK or USA) or employed shortened questionnaires, there is little evidence that the 'surgeon personality' is applicable to global populations. When considering large validation studies of the BFI worldwide, the trait domain agreeableness varies regionally, for example in African populations, the general population tends to have higher levels of this trait (3.88), compared with South America (3.52) and East Asia (3.40) [17]. When considering the trait domain openness to experience, the USA appears to

TABLE 6 Comparable item average scores for UK and Dutch gastrointestinal surgeons.

Domain	Facet	BFI item	BFI-2 item	UK score (SE)	Dutch score (SE)	*p*-value
O	Intellectual curiosity	Is ingenious, a deep thinker	Is complex, a deep thinker	3.360 (0.102)	3.850 (0.049)	<0.001
	Aesthetic sensitivity	Values artistic, aesthetic experiences	Values art and beauty	4.270 (0.070)	3.850 (0.056)	<0.001
	Creative imagination	Is inventive	Is inventive, finds clever ways to do things.	2.730 (0.114)	3.990 (0.046)	<0.001
C	Organization	–	–	–	–	–
	Productiveness	Perseveres until the task is finished	Is persistent, works until the task is finished	3.360 (0.113)	4.360 (0.039)	<0.001
		Does things efficiently	Is efficient, gets things done	3.550 (0.100)	4.210 (0.034)	<0.001
	Responsibility	Is a reliable worker	Is reliable, can always be counted on	3.630 (0.113)	4.280 (0.033)	<0.001
E	Sociability	Is sometimes shy, inhibited (R)	Is sometimes shy, introverted (R)	4.040 (0.092)	3.268 (0.062)	<0.001
	Assertiveness	–	–	–	–	–
	Energy level	Generates a lot of enthusiasm	Shows a lot of enthusiasm	3.640 (0.112)	3.930 (0.051)	0.010
A	Compassion	Can be cold and aloof (R)	Can be cold and uncaring (R)	2.961 (0.109)	4.125 (0.053)	<0.001
	Respectfulness	Starts quarrels with others (R)	Starts arguments with others (R)	2.385 (0.093)	4.311 (0.041)	<0.001
	Trust	–	–	–	–	–
N	Anxiety	–	–	–	–	–
	Depression	Is depressed, blue	Tends to feel depressed, blue	1.650 (0.067)	1.810 (0.051)	0.124
	Emotional volatility	Can be moody	Is moody, has up and down mood swings	1.620 (0.071)	1.960 (0.049)	<0.001

Abbreviations: A, agreeableness; C, conscientiousness; E, extraversion; N, negative emotionality; O, open-mindedness; R, reversed.

have the highest level globally (3.89) [21] in comparison with Eastern and Western Europe (3.54 and 3.56 respectively) [17]. Therefore, while global variation in personality traits exists (with limited investigation in previous surgeon populations) [9], no study to date has attempted to comprehensively appraise surgeon personality internationally. With the differences in personality identified within this present study from just two European countries, we would suggest that further work on clarifying global differences is necessary to understand its implications in practice, such as within clinical decision-making and teamwork [22].

Workforce and wider societal culture are likely to be influential factors in variation in international surgeon populations. For example, personality studies in other vocations (such as aerospace) have demonstrated that an individual's society or culture influences personality [23] and may account for the differences observed in this present work. Differences exist between the healthcare systems and governing policies between the UK and the Netherlands. Within an international context this may contribute, but is certainly not the only driver, to the cultures found within hospitals and individual departments, including the personality of role models, affecting the appetite to apply for a career in surgery [24, 25]. Previous studies on surgeon personality have focused largely on identifying 'risk factors' for attrition from surgical programmes based upon personality [26, 27], but floundered in identifying specific traits. This is an important consideration given recent data from the Netherlands suggesting that fewer than 7% of prospective trainees are interested in pursuing a general surgical career (with a more than a 50% decrease in interest amongst prospective male trainees and a 15%–20% decrease amongst female trainees) [28]. Such phenomena have largely been attributed to cultural changes in what is considered an acceptable work–life balance, in comparison with other surgical specialities that have seen increasing popularity, such as urology, which are considered to have a more favourable balance as well as community-based specialities such as family medicine. In other healthcare systems where there is more patient choice regarding healthcare encounters (such as in the USA), patients have been found to also consider surgeons based upon personality, reputation and experience of positive interactions, next to objective metrics such as patient outcomes [29, 30]. Thus, exploring surgeon personality in greater detail may not only be of interest to the surgical community but may interest patients too.

There were some surprising findings in this work. For example, UK-based surgeons had lower than anticipated levels of conscientiousness. This could be for three reasons: firstly bias from the comparator study (BBC News), secondly the sample of UK-based surgeons was not strictly representative of UK colorectal surgeons and thirdly differences in the types of hospital environment in which surgeons work (i.e. university teaching hospital versus district hospitals), which was not recorded in this study. Conscientiousness is associated with academic achievement [31, 32], so it may play a role in self-selection for pursuing a surgical career. We also found that, per facet, surgeons from the UK tended to have more variability within one domain than Dutch surgeons who had more consistent scoring (Table 4). The reasons behind this are unclear; however, the particularly low level of energy seen in UK surgeons (UK score; 1.870 versus the Dutch score; 4.080), may be associated with high levels of burnout in this population, as demonstrated in the most recent General Medical Council National Training Survey [33]. Burnout and surgeon personality has been explored in Dutch medical populations previously, where extraversion and emotional stability were protective factors [34], but this effect has not been explored to the same extent in surgeons from other countries or healthcare structures. Given that chronic workplace stress has been suggested to be a driver of personality change, it may be of great interest to investigate the relation between rising work pressures in the healthcare sector, job insecurity, burnout and personality shifts [35–37], as well as possible relationships with other hardships [38]. As personality has both modifiable and nonmodifiable elements, which may change in response to life experiences [39, 40], it is of importance to acquire more longitudinal data regarding surgeon personality.

Limitations

By focusing solely on gastrointestinal surgeons, we aimed to explore cross-cultural comparisons in one subspeciality group where personality has been demonstrated to influence clinical decision-making. As such, the personality 'profiles' found in this group may not be representative of other surgical specialities. Moreover, the response rate of the questionnaires that have been spread through social media cannot be measured. Subtle differences exist between the English language 44-item BFI and the Dutch 60-item BFI-2 which were used in these studies and have been discussed in greater detail previously. By comparing the cohorts relative to their reference population, direct comparisons could be performed at the domain level. However, it should be considered that differences in mean trait scores may have been present due to variation in experience and the mean age of participants of both the surgeon and normative cohorts. Furthermore, item-level comparisons, as introduced in this study, provide a comprehensive overview but are restricted as such and limit interpretation at facet and domain levels. We would advocate that future work on personality in healthcare has consensus usage of the five factor model to further improve the quality of research in this field. With any voluntary study, self-selection bias may be present and surgeons more open-minded to the concept of personality assessment (who perhaps have higher levels of open-mindedness) may be falsely present within the study sample. Personality assessment may be susceptible to social desirability response bias; however, this is considered to be reliably answered in 'nonexamined' settings [40]. As the data were collected separately, demographics were captured in different forms, for example the mean age of UK-based surgeons could not be calculated as age ranges were captured rather than exact age. While the sample of surgeons had roughly equivalent groups of male and female surgeons, this is likely an over-representation of female surgeons, given that surgery

remains male-dominated despite the changing landscape of surgical recruitment [41, 42]. The population data from the UK may also not necessarily reflect the current personality profile of the general population, given that the study was performed in 2013. Lastly, while we have drawn international comparisons from surgeon personality data for the first time, only two Western European nations (UK and the Netherlands) were included in the present study and these may not be representative of other regions.

CONCLUSION

For the first time, a comparison of international groups of gastrointestinal surgeon personalities has been made. We found that all surgeons have higher levels of conscientiousness and emotional stability, but Dutch surgeons have higher levels of agreeableness and open-mindedness compared with UK-based surgeons relative to their reference population. Given this finding, developing our understanding of international surgeon personalities is necessary as these may differ from country to country. By understanding country-specific surgeon personality traits, we may identify potential risk factors for burnout and identify psychological factors that may influence shared decision-making and clinical decision-making.

AUTHOR CONTRIBUTIONS

V. Q. Sier: Conceptualization; formal analysis; investigation; project administration; writing – original draft; writing – review and editing. **C. N. Bisset:** Conceptualization; formal analysis; investigation; project administration; writing – review and editing; writing – original draft. **D. A. J. Tesselaar:** Formal analysis; visualization; project administration; writing – original draft; writing – review and editing. **R. F. Schmitz:** Investigation; writing – review and editing. **A. Schepers:** Investigation; writing – review and editing. **S. J. Moug:** Conceptualization; investigation; writing – review and editing; supervision. **J. R. van der Vorst:** Conceptualization; investigation; writing – review and editing; supervision. **SUPER and Plato Project Collaborators:** Data curation.

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CONFLICT OF INTEREST STATEMENT

The authors declare no competing interests or disclosures.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on reasonable request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions and are stored and safeguarded accordingly.

ETHICS STATEMENT

Ethical approval was obtained from the University of Aberdeen College Ethics Review Board (CERB/2020/4/1984) with consent for subgroup analysis; the regional Dutch Medical Ethics Assessment Committee (Leiden, Den Haag, Delft) decided that this study is not subject to the Medical Research Involving Human Subjects Act (WMO). The corresponding scientific and non-WMO committee within the Leiden University Medical Centre (LUMC) gave their respective approval and nonobjection. Research data were stored according to the LUMC data management guidelines.

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