Head, heart or checklist? How self-reported decision-making strategies change according to speciality and grade

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Abstract

Purpose

To identify and analyse variations in self-reported decision-making strategies between medical professionals of different speciality and grade.

Study Design

We conducted a cross-sectional survey of doctors of different specialities and grades at St. George's Hospital, London, UK. We administered 226 questionnaires asking participants to assign proportions of their clinical decision-making behaviour to four strategies: intuitive, analytical, rule-based, or creative.

Results

We found that physicians said they used rule-based decision-making significantly more than did surgeons and anaesthetists (p=0.025) and analytical decision-making strategies significantly less (p=0.003). In addition, we found that both intuitive (p=0.0005) and analytical (p=0.0005) decision-making had positive associations with increasing experience, whereas rule-based decision-making was negatively associated with greater experience (p=0.0005).

Conclusions

Decision-making strategies may evolve with increasing clinical experience from a predominant use of rule-based approaches toward greater use of intuitive or analytical methods depending on the familiarity and acuity of the clinical situation. Rule-based strategies remain important for delivering evidence-based care, particularly for less experienced clinicians, and for physicians more than surgeons, possibly due to the greater availability and applicability of guidelines for medical problems. Anaesthetists and intensivists tend toward more analytical decision-making than physicians; an observation which might be attributable to the greater availability and use of objective data in the care environment. As part of broader training in non-technical skills and human factors, increasing awareness amongst trainees of medical decision-making models and their potential pitfalls might contribute to reducing the burden of medical error in terms of morbidity, mortality and litigation.

KEY MESSAGES

What is already known on the subject

- Clinical decision-making is a key component of non-technical skills, which are acknowledged to be of crucial importance in reducing medical error.
- Clinical decision-making strategies may be categorised as intuitive, analytical, rule-based or creative.
- Previous research has suggested that the use of intuitive decision-making tends to increase with experience.

What this study adds

- Physicians report using significantly more rule-based decision-making than do surgeons and anaesthetists, while anaesthetists report greater use of an analytical approach.
- Doctors' use of rule-based decision-making appears to be replaced by analytical and intuitive approaches with increasing experience.
- Doctors perceive that there is a lack of teaching on decision-making in UK medical training.

Research questions

- Do clinicians accurately intepret their own approaches to decision-making?
- What factors underlie the observed differences in decision-making between specialties?
- Could teaching on decision-making help to foster its development as a non-technical skill by highlighting cognitive bias?

Introduction

Non-technical skills (NTS) encompass both cognitive skills (situational awareness and decision-making) and interpersonal skills (teamwork, leadership and communication) and are regarded as essential to the delivery of good clinical care. These skills are seldom taught in early medical training, but are beginning to be incorporated into post-graduate training schemes for anaesthetists and surgeons internationally (1,2).

Medical error is complex and multifactorial; medical decision-making is a significant factor in medical error and improving our understanding has the potential to enhance patient care, whilst reducing harm and the associated costs of litigation (3,4). In 1999, the US Institute for Medicine, in its report "To Err Is Human", estimates that medical error was responsible for 44 000–98 000 deaths per year (5).

The way in which individuals make decisions has been the subject of much academic inquiry. This has led to the identification of different "systems" used to reach decisions, as discussed in several well-known books such as Kahneman's "Thinking, Fast and Slow"(6), Gladwell's "Blink" (7), and other publications (8–11).

Analysis of real-world decision-making (naturalistic decision-making) has also been a subject of study in medicine, mainly within general practice, anaesthetic and surgical settings (2,12,13). This research

has typically categorised decision-making as conscious (analytical) or subconscious (intuitive). Other decisions may be dictated by guidelines (rule-based) or, less commonly, may require creative thought processes. Real-world decision-making strategies may not fall neatly into one of these categories, but rather somewhere along a continuum, with clinicians using different strategies to different degrees, according to their experience and environmental cues.

Analytical strategies are defined by a conscious processing of each step in the decision making process to reach a conclusion. This differs to an intuitive strategy, in which clinicans will sub-consciously assimilate important clues to reach a conclusion, although when queried on their explicit process will struggle to explain their reasoning. An example of this is the oft-cited “end of the bed” judgement (11).

An increasing number of clinical decisions are dictated by previously published and evidence-based protocols, which we define as “rule-based.” These decisions are governed by further complexities such as when to apply the protocol or rule. The clinician must have an awareness of both the rule and its suitability for the particular scenario, which could be arrived at by either a subconscious (pattern recognition) or an analytical process (9). Finally, novel solutions can be defined as “creative” strategies.

A formal literature search generated considerable research on how clinical novices and experts reach their decisions. However, we found no research comparing strategies between medical specialities. Furthermore, we determined that there is a lack of research addressing how trainees perceive their own decision-making.

METHODS

Data collection

The study was designed as a cross-sectional survey of medical professionals at St. George’s Hospital, London, UK. We used a questionnaire that was previously designed for the aviation industry and that has since been used to model intra-operative surgical decision-making (15).

The questionnaire (See appendix 1) captured respondents’ views on the proportions of their clinical decision-making (expressed as percentage points) that they would classify into each of the following four strategies: rule-based, analytical, intuitive, and creative.

Respondents were also asked to state whether they had previously received formal training in clinical decision-making and whether they would like training in the future. Information was collected on respondents’ speciality, grade and number of years of experience.

The goal of the study was to analyse the response data by speciality and grade to assess whether different models of decision-making predominate in different specialties and to infer from associations between grade and type of decision-making how approaches might evolve with increasing experience. Purposive sampling was used in an attempt to sample clinicians from medicine (physicians), surgery and critical care (encompassing anaesthetics and intensive care unit doctors). Clinicians not falling into these cohorts, including those from emergency medicine, paediatrics, radiology, microbiology, and histopathology, were classified separately. Paper questionnaires were distributed to 226 trainees and consultants in total. A breakdown by grade and speciality is provided. in Table 1. Respondents were approached during visits to departmental meetings and ward rounds, and questionnaires were completed and returned in the course of one face-to-face encounter.

Table 1. Respondents by grade and type of speciality

Grade	Total	Medical specialtie	Surgical specialtie	Anaesthetics / ICU	Other	N/A or
Consultant / Non-training	27	13	7	2	5	0
Consultant / Non-training	56	22	17	8	9	0
Specialis t	81	29	18	16	17	1
Core trainees	30	15	4	4	4	3
Foundation year	32	1	4	1	0	26
Total	226	80	50	31	35	30

This type of data collection raises ethical questions around how able participants will have felt to withdraw and how confidential they will have thought were their responses. Every effort was made to ensure subjects understood the voluntariness of their participation and their right to withdraw. Data collectors did not have any supervisorial role nor any contribution to progression reviews in relation to potential participants. It was stressed that responses would not be viewed by data collectors in order to maintain confidentiality and prevent the introduction of bias.

The study received formal ethical approval from the St. George's, University of London ethics committee and was registered with with the Integrated Research Application System (Project ID 132897).

Statistical analysis

As there were 5 speciality groups (surgeons, anaesthetists, physicians, radiologists and other), it was not appropriate to perform a series of t-tests, so points allocated to each decision-making strategy (mean ± standard error of mean) were compared between specialties by one-way analysis of variance (ANOVA) with Dunnett's multiple comparison post-test to compare the groups. The proportion of respondents receiving formal training was examined using Fisher's exact test. Points allocated by grade were analysed by categorical regression (16) using SPSS v. 21, with the dependent variable as the allocated score, and grade as an ordinal (see table 2). Although it would have been relevant to include speciality as a co-variate, this was not possible as speciality is only defined for consultants and speciality registrars, not for lower grades.

Table 2. Categorical regression of decision score by grade

Decision type	Beta coefficient	Std error estimate	P value	Strength of association with
intuitive	0.19	0.06	<0.0005	Moderate positive
analytical	0.20	0.06	<0.0005	Moderate positive

rule-based	-0.34	0.05	<0.0005	Moderate negative
creative	0.04	0.11	0.91	None

* The beta coefficient indicates both the direction of association (i.e. positive coefficient means that that decision type is increasingly used as grade increases, negative means that it is decreasingly used) and the effect size (a larger number indicates a greater effect).

RESULTS

Decision-making strategies varied between the four specialities, as indicated in Figures 1 and 2. Rule-based decision-making was allocated 38±2 points by physicians, on average just over a quarter more than allocated to that approach by surgeons (30±2) (Figure 2B; p=0.025). Physicians allocated 30±2 points to analytical decision-making, whereas both surgeons (40±3, p=0.003) and anaesthetists (41±3, p=0.03) allocated on average approximately a third more points to this strategy (Figure 2C). Anaesthetists also allocated fewer points to rule-based decision-making than physicians (29±2) , but this outcome failed to reach statistical significance (p=0.07). Intuitive decision-making was allocated 24±2 percentage points by physicians, and although the number of points allocated by radiologists or other specialities appeared lower, this was not a statistically significant difference (Figure 2A). All specialties allocated less than 10 points to creative decision-making, and there were no significant differences between the groups.

When analysed by grade (Figures 3 and 4), we found that the number of points allocated to intuitive (p<0.0005) and analytical (p<0.0005) forms of decision-making positively correlated with increasing grade, whereas the number of points assigned to rule-based decision-making had a negative association with degree of seniority (p<0.0005). The number of points allocated to creative decision-making did not change with grade (p=0.9).

In total, 22 out of 108 physicians (20%) reported receiving formal training on decision-making, which was slightly, although not significantly, higher than the proportion of anaesthetists and intensivists (4/30; 13%) and surgeons (12/88; 14%) who reported receiving formal training on decision-making. Furthermore, 73 physicians (68%), 23 anaesthetists (74%), and 47 surgeons (53%) indicated that they would like to see further training in decision-making incorporated into their training.

DISCUSSION

How strategies vary by grade

Intuitive and analytical decision-making is positively associated with increasing experience

We had hypothesised that analytical decision-making would predominate amongst specialist trainees, and that senior doctors (consultant or equivalent) would employ a greater proportion of intuitive decision-making.

Previous studies have shown that, due to a lack of previous exposure, junior trainees rely more on analytical approaches to interpreting data (17,18). Shiralkar (19) explored this idea by asking

different grades of surgeon to outline a management strategy for the same clinical presentation of a common surgical problem. The registrars objectively demonstrated a more analytical approach than consultants, as registrars consciously compared and balanced multiple pieces of information before coming to a rational decision. A suggested reason for this approach is that the registrars did not have the requisite breadth of experience in similar scenarios to make decisions more efficiently. The consultants, in contrast, appear to arrive at their conclusions without consciously processing much of the information considered by junior clinicians. However, in our results, both analytical and intuitive decision-making strategies correlate with increasing experience.

The context in which a decision has to be made has been shown to have an effect on which decision-making strategy is chosen. In aviation situations, which are dangerous and in which there is limited time to act, pilots invariably use intuitive or rule-based decisions (20). Flin *et al.* (21) suggest that the rationale underlying this behaviour is that the time required for an analytical approach that simultaneously compares a number of courses of action is not sufficiently efficient to deal with an urgent problem. However, in a scenario where time is more abundant, a conscious analytical approach comparing alternative courses of action may indeed be the optimal approach. Therefore, we suggest that more experienced clinicians merely use the decision-making strategy that is optimal given the circumstances faced. Moreover, their breadth of experience may allow them to use intuition more frequently than junior clinicians, and their depth of knowledge may allow them to more frequently use analytical strategies where appropriate.

Additional research from Cristancho *et al.* (22), on how expert cognition develops found that those clinicians with less experience focused on information at a physiological or pathophysiological level, in contrast to experts who subconsciously focused on "the bigger picture," more readily putting new data into the clinical context. Our study did not demonstrate a significant evolution of analytical-tointuitive processes with increasing experience; however, this may be due to a lack of awareness amongst the respondents on the subtleties of their decision-making processes (23).

Rule-based decision-making is negatively associated with increasing experience

Our results support the idea that senior clinicians rely less on guidelines and rule-based thought processes, and more on their accumulated experience, to make decisions.

There are multiple reasons why juniors use guidelines in decision-making. First, junior clinicians have less experience with which to inform their actions, and may require direction to conduct safe and effective medicine (24). Second, the types of decision being made at a more senior level tend to be more complex, presumably making it more difficult to construct or apply a set of relevant guidelines or rules. Decisions surrounding whether to perform a certain diagnostic test or instigate treatment increasingly require senior input prior to implementation. Third, protocols and guidelines are designed to be summaries of the best available evidence. In the era of evidence-based medicine, there is substantial pressure for clinical decisions to be made with consideration of all available evidence . This is challenging given the quantity of evidence

and the quantity of clinical decisions being made. Whereas senior clinicians will feel more confident making their decisions (and are ultimately responsible for them), junior-level staff may prefer to rely on rule-based decision-making. However, as Crebbin *et al*. highlight in their model on decision-making (13), one has to have both an awareness of a guideline and also its applicability to a scenario to use it.

Creative thinking is uncommon at any level of experience

Our results show that creative (novel) solutions in clinical decision-making are uncommon. Within medicine and anaesthetics, we could not find any published literature on truly novel solutions to common problems. Flin et al. suggested examples in surgical settings (21), but later qualitative research failed to find significant evidence of use of such an approach to decision-making by surgeons in the operating theatre (12).

How strategies vary by speciality

Physicians use rule based decision-making significantly more than surgeons and critical care

One explanation for the more frequent use of rule-based decision-making amongst physicians is the greater availability of clinical practice guidelines in medical specialties. The rise of the evidence-based medicine movement in the 1990s has led to an exponential increase in the number of such guidelines. This has been more pronounced in medical as opposed to surgical specialties, possibly because drug treatments more easily lend themselves to investigation in randomised controlled trials than surgery given the greater ease of blinding and double-blinding (25).

An additional explanation for the greater relative use of rule-based decision-making by physicians as opposed to surgeons is the nature of surgical decision-making. Whereas the prevalence of guidelines in medical specialties has led to increasing “protocolisation” in the management of common medical emergencies, with algorithms based on objective measures such as vital signs and blood tests, decision-making regarding the management of surgical emergencies has proved more resistant to such standardisation (25). Previous analysis examining how surgeons make decisions has shown that an intuitive and analytical approach is used for decisions requiring a higher degree of uncertainty, whereas decisions on routine intraoperative procedures tend to follow a more rule-based approach (26). This may also be reflected in our results, where uncertain situations are more likely to be dealt with by clinicians of increasing seniority.

Critical care doctors use analytic decision-making significantly more than physicians

Our results suggest that anaesthetists and intensivists utilise a greater proportion of analytical decision-making than do physicians. Anaesthetics and intensive care were the first branches of medicine to evaluate decision-making in the framework of NTS and to introduce related training (1,27,28). Studies in both medical and surgical intensive care units (ICUs) have shown a predominance of analytical decision-making (29).

The more commonly cited use of analytical thought by anaesthetists and intensivists could potentially be explained by the nature of their work environments. In both the intensive care environment and operating theatre, there is a relative abundance of parameters immediately available to the clinician to represent the physiological state, when compared with an outpatient clinic or even a general medical inpatient setting. Decisions are therefore taken on objective data, and fewer decisions are reached in a "subjective" manner, such as asking patients about their symptoms.

Finally, it is worth highlighting the low numbers (under 20%) of trainees and consultants in our study who had received any explicit training in decision-making; this trend was found across all specialities. Nevertheless, a high proportion of respondents were enthusiastic about receiving further training. Given this enthusiasm there should be scope for lessons to be drawn from other safety-critical industries such as aviation and the military (30) . For example, pilots are required to attend "human performance" courses, which could also become mandatory for medical trainees to increase awareness.

LIMITATIONS

From our data we have noted associations between degree of experience and types of decision-making. It is important to note that due to the cross-sectional nature of the study, it is not possible to draw direct conclusions about how decision-making strategies evolve over the course of doctors' careers. This would only be possible with a longitudinal study design following up the same subjects over time.

Our questionnaire asked clinicians to categorise their own decision-making. This type of self-reported data is likely to suffer from recall and reporting bias. For example, many clinicians would have quickly recognised that we were expecting to find a correlation between clinical experience and intuition and, if they themselves were more senior, may have attributed many of their decisions to intuition, even if their attribution did not accurately reflect their clinical practice.

Decision-making is not only affected by personality, but also context, including organisational culture, the immediate healthcare setting, the time available and the degree of uncertainty involved. These factors may vary between departments in different healthcare organisations, and we are unable to discount resulting bias due to the conduct of our study on single site. We designed our data collection tool to allow for recruitment of an adequate number of participants with the limited time and resources at our disposal. A drawback of the simplicity of the questionnaire was that respondents were only able to summarise their general approach to clinical decision-making according to predetermined categories, without providing any fine detail as to which factors, such as those mentioned above, might affect their decision-making in specific scenarios.

FUTURE WORK

One future approach could be to follow up the same clinicians at different points in their career and measure the types of decision-making used. This might allow for more robust conclusions on how decision-making develops with experience, as opposed to the inferences we have drawn from associations in our data.

Future work on this subject could also include real-time study of clinical decision-making. This might allow respondents to more accurately characterise their approach by eliminating some of the recall and reporting bias likely to be present in our data.

Qualitative interviews would provide much greater granularity in terms of the factors contributing to the differences observed between grade and speciality, and provide information on other contextual elements that have a bearing on decision-making. It would be most helpful if future studies were conducted across several organisations (and ideally regions) in an attempt to eliminate confounding due to differences in organisational culture and healthcare setting.

Finally our data have highlighted a perceived lack of teaching on decision-making received during medical training. Non-technical skills such as clinical decision-making are increasingly recognised as important in reducing medical error. Therefore increasing awareness of the nature of decision-making, and fostering its development as a skill, would seem legitimate aims for medical educators. Possible educational avenues to be explored, alongside formal teaching on decision-making, include encouraging follow-up of patients after acute assessments (difficult in a shift-work environment but becoming easier with the introduction of electronic notes in some organisations), and reflective debriefs with seniors around complex cases (11). A future longitudinal study could look to evaluate the effectiveness of such interventions in improving decision-making and reducing error.

CONCLUSION

Our results suggest decision-making strategies may evolve with increasing experience and also differ between medical specialities. There is a perceived unmet need to provide clinicians with explicit training in decision-making. Increasing awareness of the different strategies, alongside their potential pitfalls, offers the potential for diagnostic reasoning to be improved and patient safety enhanced.

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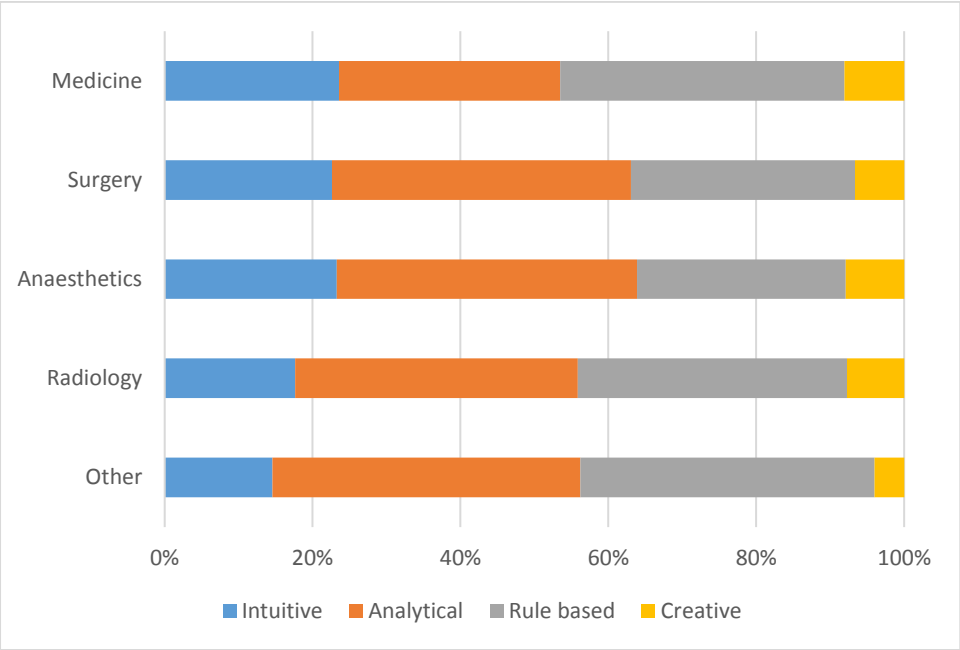
Figure 1. Self-reported decision-making strategies vary according to speciality



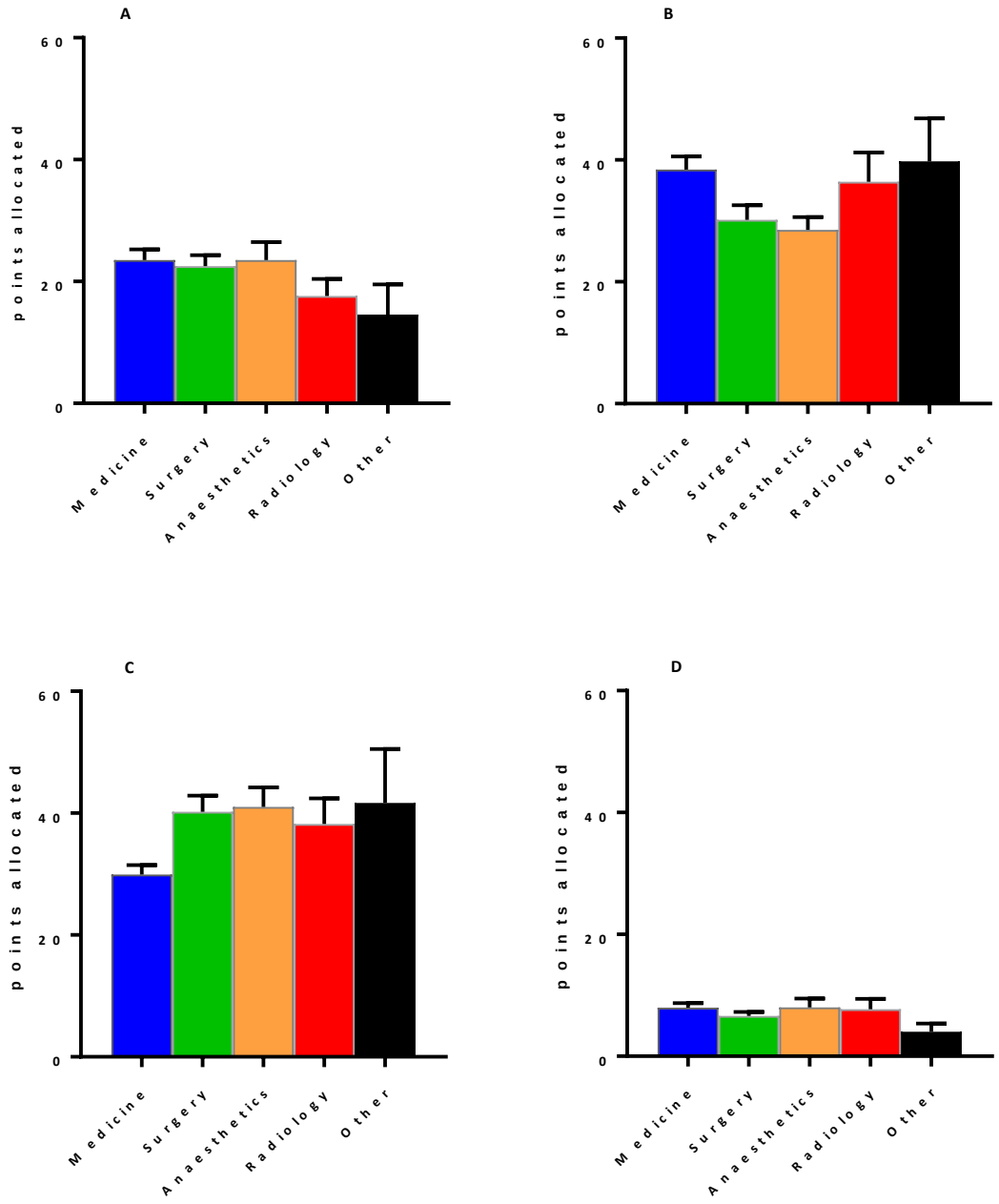


Figure 2. Self-reported decision-making strategy by speciality (mean±SEM)
A - intuitive; B – rule-based; C – analytical; D - creative

Figure 3. Self-reported decision-making by grade

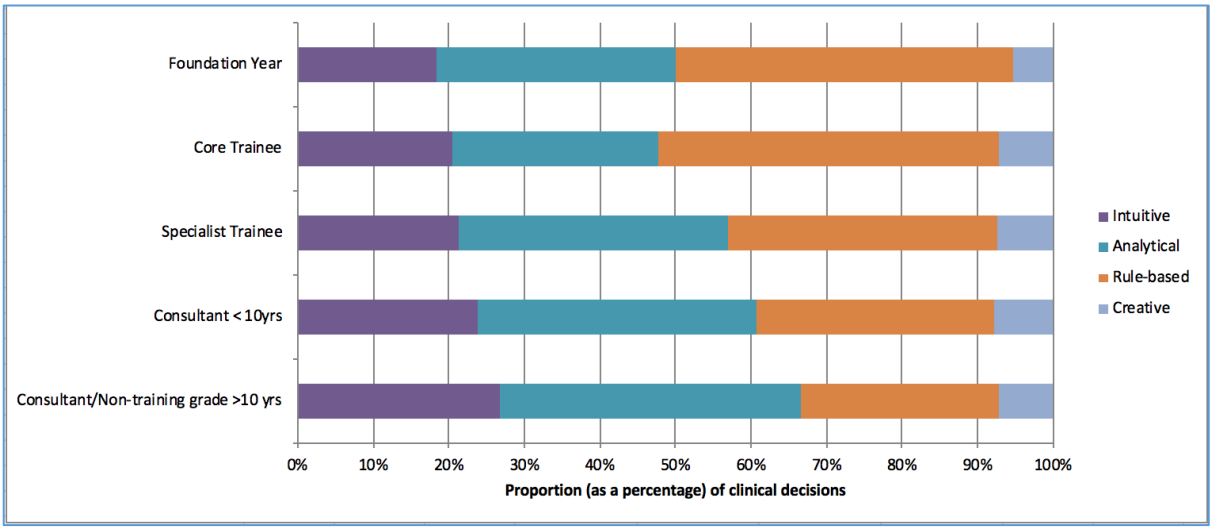
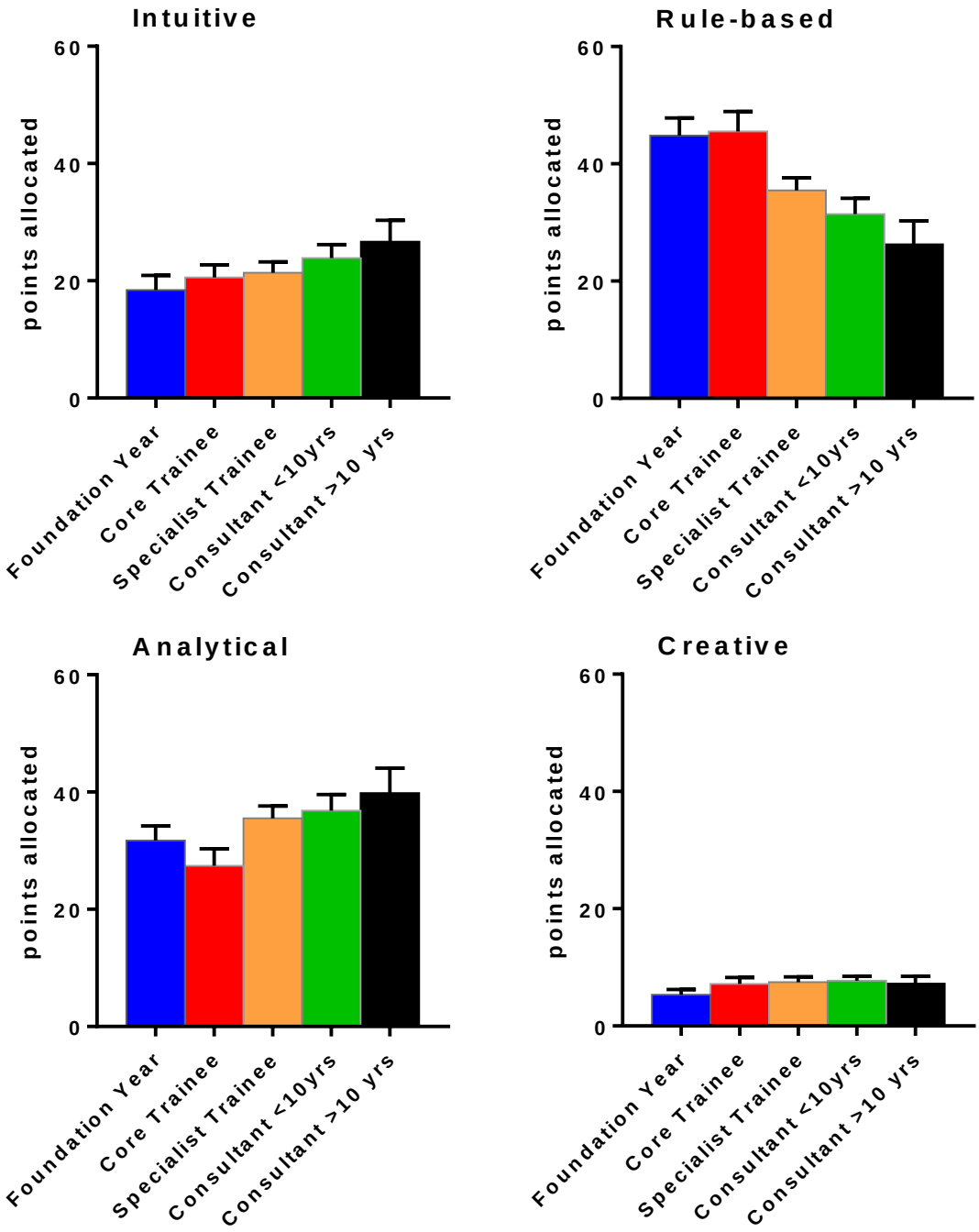


Figure 4. Self-reported decision-making by grade



Appendix 1. The Questionnaire

Dear Doctor,

There is a perceived lack of teaching on the decision-making process for medical students and doctors. Contemporary research identifies non-technical skills to be of use in surgery and we are hoping to extend this research to other fields.

We are looking to investigate decision-making in the medical environment. We are looking to see how decision-making patterns change according to both experience and specialty.

This questionnaire aims to discover your personal experiences in decision-making and whether you have had any formal training. We hope by completing this questionnaire it will increase your awareness of decision-making strategies and we aim to present these results as a basis for further research.

Thank you for answering these three short questions:

Grade

FY □ CT □ ST □ GP Trainee □

Consultant / Non-training grade

0-10yrs □ >10yrs □

Specialty.....

1. Have you had any formal training in decision making? Y / N If so, please provide a brief description (e.g. course, lectures,)

2. It is thought that the decision making process can be dissected down to the following four strategies.

Please put an approximate percentage describing the relative proportions of the methods below that you employ for your clinical practice.

A. **INTUITIVE (gut feeling)** - thought to be borne out of experience. Cannot necessarily explain the steps that led to the decision but previous experience led you on to your next action .....

B. **RULE BASED** - guidelines dictate your clinical decision.....

C. **ANALYTICAL** - your next action depended on a conscious thought process.....

3. Do you feel that more training should be offered in developing decision making skills in medicine? Y / N

Many thanks for your participation in this questionnaire.