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Brief Reports

COGNITIVE BIASES IN EMERGENCY PHYSICIANS: A PILOT STUDY

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☐ **Abstract—Background: Cognitive bias can lead to systematic errors in judgment. Objective: We sought to assess cognitive bias in emergency physicians and compare the results to a sample of nonphysicians. Methods: Selected emergency physicians were invited to take the Rationality Quotient (RQ) test, which measures cognitive biases. Control subjects were nonphysicians selected randomly from individuals who had taken the RQ test contemporaneously. We compared RQ scores overall and by bias and assessed the relationship between self-reported statistical knowledge and familiarity with decision-making biases and RQ scores. Results: Of 150 physicians invited, 95 (63%) completed the RQ test. There was less bias in physicians compared with control subjects (RQ scores were 51.1 for physicians and 43.3 for control subjects, $p < 0.001$). There was less bias among physicians for both bias blind spot (15 vs. 14.3, $p < 0.001$) and for representative bias (10.4 vs. 5.2, $p < 0.001$). Anchoring bias, confirmation bias, projection bias, and attribution error were not significantly different. Emergency physicians with greater self-reported statistical familiarity (either 6 of 7 or 7 of 7 on a Likert scale) had higher RQ scores by 7.7 points (95% confidence interval 3.1–12.3)—i.e., they were less biased. There was no association between self-reported knowledge of decision biases and RQ scores. Conclusion: Cognitive biases were common in this sample of emergency physicians, and physicians demonstrated less bias than control subjects. Variability was mostly attributed to 2 biases: bias blind spot and representative bias.**

☐ **Keywords—anchoring; bias blind spot; cognitive bias; emergency; emergency medicine; medical decision making; patient safety; representative bias**

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INTRODUCTION

Decision science has identified many cognitive biases that impact decision making and judgment in everyday life, including medicine. Decision-making shortcuts, called "heuristics," can lead to systematic errors in judgment. In medical care, these errors can impact care and outcomes. Cognitive biases impact probability estimation and information synthesis, two important skills to the practice of medicine. A recent review linked bias to poorer diagnostic accuracy, patient adherence, and physician–patient communication (1). Emergency medicine may be particularly prone to cognitive bias because of the need for rapid decision making, undeveloped physician–patient relationships, and incomplete information (2). One example of cognitive bias that particularly impacts emergency medicine is confirmation bias: the tendency to search for or interpret information so that it confirms pre-existing beliefs rather than look for disconfirming evidence (3). This can occur when clinicians are focused on a single diagnosis and ignore new data that may disconfirm it. To our knowledge, there has been no broad assessment of cognitive bias among emergency physicians in the published literature.

In this study, we assessed cognitive bias in emergency physicians and compared these results to a sample of

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nonphysicians. Our goals were to assess the degree to which cognitive bias exists in emergency physicians and how these biases compare to nonphysicians. We hypothesized that emergency physicians would be less biased than nonphysicians, and that this may differ by specific biases.

MATERIALS AND METHODS

Study Design and Setting

We conducted a was a cross-sectional study. We invited select emergency physicians to take the Rationality Quotient (RQ) test (Correlation One, Inc, New York, NY), which measures the ability to process information logically and mitigate cognitive biases. This was approved by the Institutional Review Board at George Washington University.

We identified a total of 150 emergency physicians, primarily through personal relationships with an author (JMP). Each physician was invited up to 3 times between March 2018 and May 2018 to complete the 45-min RQ test. There was no incentive other than the fact that each completer received an assessment of their own bias. For controls, we selected 225 individuals randomly from individuals who had contemporaneously taken the RQ test. The larger sample was comprised primarily of individuals who took the test as part of a job application process. They spanned variable role functions, industries, and U.S. geographies; however, none were physicians.

The RQ Test

The RQ Test was developed by Correlation One, a private company, based on research in decision and cognitive sciences from the work of Kahneman and Tversky and from several validated tools (e.g., the Adult Decision Making Competence and the Assessment of Biases of Cognition) (4–6). The RQ Test used in this study has not been formally validated itself; however, its components were generated from validated instruments. It should also be differentiated from the Rationality Quotient test developed by Stanovich et al., which is a different instrument (7).

Correlation One's RQ Test contains 47 total tasks with either multiple-choice or numerical responses. Scores range from 0–100; higher scores indicate a greater ability to mitigate bias and make rational decisions. The RQ Test measures 6 biases: (1) anchoring, (2) confirmation bias, (3) representative bias, (4) projection bias, (5) attribution error, and (6) bias blind spot. (Definitions of these biases appear in Figure 1.) Participants also shared demographic information and self-assessed their own familiarity with statistics and cognitive biases using Likert scales (from 1–7).

Data Analysis

We used standard descriptive statistics to tabulate RQ Test results overall and for each bias and compared responders with nonresponders to assess nonresponse bias among the emergency physician group. We also compared the results to control subjects using *t* tests as results were normally distributed as well as the Fisher exact test for categorical data. Linear regression analysis was used to assess the relationship between self-reported statistical knowledge and familiarity with decision-making biases and RQ scores. Analyses were conducted with statistical libraries developed for the Python programming languages, specifically pandas, numpy, and scipy.stats (8). p values < 0.008 were considered significant for all comparisons, which accounted for the multiple comparisons in this study using the Bonferroni correction.

RESULTS

Of 150 emergency physicians invited, 95 (63%) completed, 22 (15%) partially completed, and 33 (22%) did not start the RQ Test. Comparing 95 completers with 33 noncompleters, there were no significant differences in age, gender, or academic vs. community emergency departments (EDs). In completers, 63% were male, the greatest proportion were in their 40s (45%) or 30s (35%), 95% were attending emergency physicians, and 75% worked in academic ED settings. Median reported statistical familiarity was 5 of 7

Anchoring: The tendency to rely too heavily on the first piece of information offered (the "anchor") and failing to adjust to subsequent information when making decisions

Confirmation Bias: the tendency to search for or interpret information in a way that confirms one's preexisting beliefs rather than look for dis-confirming evidence.

Representative Bias: The tendency for people to rely on prototypical rather than atypical presentations of illness.

Projection Bias: The tendency to unconsciously assume that other people share one's own emotional states, thoughts, knowledge, and values

Attribution Error: The tendency to overemphasize individual dispositional factors when observing others, while underemphasizing the role and power of situational influences.

Bias Blind Spot: The tendency to be overconfident in one's own aptitude and abilities; the tendency to be able to recognize thinking errors in others, but to be blind to one's own biases.

Figure 1. Biases Tested.

(interquartile range [IQR] 4–6) and familiarity with decision biases was 5 of 7 (IQR 5–6).

Higher scores on the RQ Test signify less bias. The average RQ Test score was 51.1 (standard deviation [SD] 11.6) in physicians and 43.3 in control subjects (SD 9.6): the difference was 7.8 (95% confidence interval [CI] 5.1–10.4, $p < 0.001$), meaning that there was less bias in physicians. Bias blind spot scores were higher in physicians (15.9 [SD 2.4] vs. 14.3 [SD 3.1]): the difference was 1.6 (95% CI 1.0–2.2, $p < 0.001$), as were scores for representative bias (10.4 [SD 4.7] vs. 5.2 [3.6])—the difference was 5.2 (95% CI 4.1–6.3, $p < 0.001$); i.e., there was less bias in physicians. Scores on anchoring bias (7.2 [SD 3.0] vs. 6.9 [2.7], $p = 0.47$), confirmation bias (8.1 [SD 3.6] vs. 7.5 [SD 3.6], $p = 0.20$), projection bias (3.8 [SD 2.8] vs. 4.1 [SD 3.0], $p = 0.38$), and attribution error (5.6 [SD 2.7] vs. 5.2 [SD 2.3], $p = 0.13$) were not statistically different. Emergency physicians with greater reported statistical familiarity (Likert scores of 6/7 or 7/7) had higher RQ scores by 7.7 points (95% CI 3.1–12.3, $p < 0.001$). There was no association between knowledge of decision biases and RQ scores, with a difference of 3.5 (95% CI −1.2 to 8.3).

DISCUSSION

In this small pilot study, we found that cognitive biases are demonstrable among emergency physicians and that there is considerable variance among this group. Physicians with greater self-reported statistical knowledge tend to have less bias, while knowledge of cognitive biases itself did not predict measured bias. This suggests numeracy may be more important than knowledge of bias when it comes to actual cognitive bias, at least in this sample of physicians. Future work should study the relationship between numeracy and bias and how it predicts complex clinical decisions.

Compared with control subjects, emergency physicians demonstrated less bias overall. This may be because sampled physicians have more education, were older, or may have had more experience with multiple choice testing. It is also possible that clinical experience may impact observed cognitive bias, particularly with experiences that bring immediate feedback (i.e., interactions with patients and other physicians) or delayed feedback (i.e., negative or malpractice). This should be studied further.

Areas where physicians were less biased included bias blind spot and representative bias. Bias blind spot (i.e., failing to recognize your own biases) may be lower because emergency physicians may be made aware of cognitive biases through training and experience. Representative bias (i.e., over- or underestimating the probability of an event by not considering base rates) was also lesser among emergency physicians, possibly because emergency physicians have experience estimating the probability of clinical events, relying on the base rate (i.e., the risk in the population)—for example, assessing the risk that an individual has pulmonary embolism and considering the prevalence of pulmonary embolism in ED patients with a particular presentation (9). Other biases in general were not significantly different, suggesting that physician and experience training may have a lesser effect on other biases.

Limitations

There are several limitations. First, this was a small sample of emergency physicians primarily from academic settings, and many were midcareer who had a previous relationship with the study author, an academic emergency physician. Therefore, the results may not be representative of all emergency physicians. Second, our control group included primarily nonphysician, college-educated job applicants, many of whom were younger with less education than physicians. We also did not gather demographic data on the control group, which limits the ability to assess differences in samples. Therefore, the comparison of samples should be considered exploratory. Third, the RQ Test did not focus on risk tolerance and diagnostic bias/premature closing, which may be more specifically relevant to emergency medicine and have been studied in other publications (10). The RQ Test has also not been formally validated as an instrument—particularly the additive nature of the biases for an overall score. Fourth, the questions on statistical and cognitive bias familiarity were not validated. Finally, while our study demonstrates the presence of cognitive biases among emergency physicians, no definitive studies have linked specific biases to actual diagnostic errors or poorer outcomes.

CONCLUSION

In this sample of emergency physicians, we found variable scores on an RQ Test that tests the ability to apply statistical thinking and mitigate cognitive bias. This was driven by higher scores in two biases: bias blind spot and representative bias.

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ARTICLE SUMMARY

1. Why is this topic important?

Cognitive bias is an important factor of medical decision making and may impact patient safety.

2. What does this study attempt to show?

This article aims to assess cognitive bias in emergency physicians and compare results to a sample of non-physicians.

3. What are the key findings?

We found less bias in emergency physicians compared to controls, particularly in bias blind spot and representative bias. Physicians with greater self-reported statistical familiarity were less biased.

4. How is patient care impacted?

Understanding that emergency physicians have cognitive bias is an important first step in designing interventions to reduce bias and potentially improve patient safety.