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Teaching metacognition in clinical decision-making using a novel mnemonic checklist: an exploratory study

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ABSTRACT

Introduction: Metacognition is a cognitive debiasing strategy that clinicians can use to deliberately detach themselves from the immediate context of a clinical decision, in order to reflect upon the thinking process engaged. However, the use of cognitive debiasing strategies is often most needed in occasions where the clinician cannot afford the time to do so. A mnemonic checklist known as the TWED checklist (where T = Threat, W = What else, E = Evidence and D = Disposition influence) was recently created to facilitate metacognition. This study explores the hypothesis that the TWED checklist improves the ability of medical students to make better quality clinical decisions.

Methods: Two groups of final year medical students from Universiti Sains Malaysia, Malaysia, were recruited for participation in this quasi-experimental study. The intervention group (n = 21) received educational intervention introducing the TWED checklist, while the control group (n = 19) received a tutorial on basic electrocardiography. Post-intervention, both groups received a similar assessment on clinical decision making based on five case scenarios.

Results: The mean score of the students in the intervention group was significantly higher than that of students in the control group (18.50 ± 4.45 marks vs. 12.50 ± 2.84 marks, $p < 0.001$). Specifically, in three of the five case scenarios, the students in the intervention group obtained higher scores than the students in the control group.

Conclusion: This results of this study supports the use of the TWED checklist to facilitate metacognition in clinical decision-making.

Keywords: checklist, cognitive bias, cognitive debiasing strategy, medical education, metacognition

INTRODUCTION

According to the dual process theory, there are two types of decision making – Type 1 and Type 2.[1-5] The defining feature of Type 1 decision-making is automaticity, which facilitates fast decision-making independent of higher-level control.[4,5] The defining feature of Type 2 decision-making is cognitive decoupling, which involves the analytical ability to compare and contrast alternatives using imagination before making a decision.[4,5]

Clinical decision-making is a complex process involving interaction between both Type 1 and Type 2 processes.[1,6,7] Type 1 decision-making results in fast and accurate clinical decisions, particularly if the decision maker is an experienced clinician who is armed with the necessary knowledge, skills and experience (collectively known as 'mindware').[8] However, Type 1 decision-making is more affected by cognitive biases than Type 2 decision-making.[6,9] Defined as our deviations from rationality,[10] cognitive biases may derail clinicians into medical errors if left unchecked.[9] Numerous cognitive biases have been identified; common ones include availability bias, anchoring, confirmation bias and search satisficing.[11] A brief description of these four common cognitive biases is given in Table I.

Table I. Common cognitive biases in clinical medicine.

Cognitive bias	Description
Availability bias	The tendency of clinicians to judge things as being more likely, or frequently occurring, if they readily come to mind.[11] For example, if a clinician has a recent experience with thoracic aortic dissection, it may inflate the likelihood of the clinician diagnosing a patient who presents with chest pain with this disease.
Anchoring	The tendency of clinicians to fixate their perception on the salient features of a patient's initial presentation at an early point of the diagnostic process, such that they fail to adjust their initial impression even in light of later relevant information.
Confirmation bias	The tendency of clinicians to look for confirming evidence to support the diagnosis they are 'anchoring' to, while downplaying, ignoring or not actively seeking evidence that may point to the contrary.
Search satisficing	The tendency of clinicians to stop looking or to call off a search for a second diagnosis when they have found the first one. This bias can be detrimental in polytrauma cases.

Many strategies to reduce cognitive biases (i.e. debias) have been proposed.(11-13) A common denominator undergirding these strategies is critical self-reflection with a heightened sense of vigilance.(9,12) Metacognitive regulation (i.e. thinking about thinking) is one such strategy; it is defined as the ability to deliberately detach oneself from the immediate context where the decision is made in order to reflect on the thinking process engaged.(11,12) Metacognition allows one to check for conflicting evidences and to consider alternatives to the decisions made.(12)

However, cognitive debiasing is easier said than done.(11,14,15) Generally, a lingering mood of pessimism prevails on how best to put debiasing strategies into practice.(9,11,15) This challenge is particularly germane to clinical decision-making in a stressful environment such as the emergency department.(16) When clinicians are busy, they may be more likely to use Type 1 decision-making,(3) as it affords them the ability to make swift, automatic and reflexive decisions. Furthermore, as many of these cognitive debiasing strategies take time and slow down the entire clinical decision-making process, they may be ineffective in reducing medical errors.(17) When the emergency department is not operating under stressful conditions, the clinicians theoretically have more time to analyse the situation critically, to ensure that nothing of importance is missed. This is paradoxical as it is during stressful environments that cognitive debiasing strategies are most needed. Therefore, it has been theorised that the process used to effectively debias cognitive biases (which occur more commonly in Type 1 thinking) should be a Type 1 thinking process. That is, the strategy must be easily retrievable and automatised to a large degree in a stressful environment.

The TWED checklist (Fig. 1) is a novel innovation that was recently created; it is a mnemonic checklist designed to help reduce cognitive bias. The four letters in 'TWED' stand for **T**hreat ("Is there any life or limb threat that I need to rule out in this patient?"), **W**hat else ("What if I am wrong? What else could it be?"), **E**vidences ("Do I have sufficient evidence to support or exclude this diagnosis?") and **D**isposition influence ("Is there any disposition influence that affects my decision?"). Disposition influence consists of two 'E's: (a) environmental factors (e.g. a stressful clinical setting); and (b) emotional factors (e.g. fatigue and anger). These two 'E' factors have been shown to affect the frequency at which clinicians commit cognitive biases.

The present study aimed to test the hypothesis that the TWED checklist is able to facilitate metacognition among medical students so that they are able to make better quality clinical decisions. This was measured by the ability of the students to generate a second, more serious diagnosis and their ability to decide for appropriate investigations and management plans.

METHODS

This study was approved by the Ethics and Research Committee of Universiti Sains Malaysia, Malaysia. Two groups of final year (i.e. Year 5) medical students from the class of 2013/14 of Universiti Sains Malaysia were selected for this quasi-experimental study. The intervention group (n = 21) received educational intervention that consisted of a 90-minute tutorial on cognitive biases and debiasing strategies. The tutorial included an introduction on the dual-process theory of thinking, and a discussion on various common cognitive biases, cognitive debiasing strategies and the TWED checklist. The students in the intervention group were also given a demonstration of how to apply the TWED checklist in clinical cases. During the tutorial, the tutors emphasised that the TWED checklist is not an instantaneous solution and that it requires repetitive practice in a clinical setting. The control group (n = 19) was not exposed to this educational intervention. Instead, they received a 90-minute tutorial on basic electrocardiography.

A set of five clinical case scenarios was used as the assessment tool for this study. These five case scenarios were designed to test the ability of the students to look beyond the apparent diagnoses to generate alternative hypotheses or diagnoses. The cases were framed such that they would lead the students into making an obvious diagnosis. These obvious diagnoses, although not necessarily incorrect, were not the critical diagnoses. In each case, other than the clinical signs that pointed towards the obvious diagnosis, there were other subtle clinical cues that indicated the likelihood of a more urgent or life-threatening diagnosis that should be considered. In real-life situations, the failure to consider these diagnoses may be detrimental to the patient. Common potential cognitive biases were embedded in each of the cases (availability bias was embedded in cases 2, 3 and 4; anchoring was embedded in case 4; confirmation bias was embedded in cases 4 and 5; and search satisficing was embedded in all 5 cases).

Undergirding the construction of these cases was the theoretical notion that the students would be more likely to pick up the alternative diagnoses if they reflected on the questions posed in the TWED checklist. Each case scenario had 2–3 questions; one question tested the students on their ability to generate alternative diagnoses that should be considered, while 1–2 questions tested the students on their ability to make decisions on various management aspects of the case (e.g. whether certain investigations or treatment modalities needed to be performed and whether the patient should be discharged). The maximum allotted marks for each question was made known to the students. Detailed descriptions on the objectives of the five cases, the embedded cognitive biases, as well as how the TWED checklist is able to help promote metacognition are outlined in Appendix 1.

During the first week of their emergency medicine posting, the students in the intervention group received a 90-minute tutorial on cognitive biases and debiasing strategies (i.e. the educational intervention), while the students in the control group received a 90-minute tutorial on basic electrocardiography interpretation. Two weeks later, the students in both groups were asked to independently and anonymously complete the test on the five case scenarios. The students in the intervention group were asked to think about their initial impressions of, or diagnoses for, these cases before reflecting on the questions in the TWED checklist.

A prior quiz, in the form of 20 true-or-false factual recall questions, was administered to the students in both groups before they started working on the test on the five cases scenarios. This quiz was immediately followed by correct-answer feedback and it was not scored. The purpose of the quiz was to ensure that the students had the necessary knowledge to answer the questions in the case scenarios. For example, to ascertain that the students had the necessary knowledge to answer case 1 (described in Appendix 2), a mixture of related and unrelated toxicology questions (e.g. questions on the manifestations of cholinergic, anticholinergic, sympathomimetic and opioid toxidromes) were asked in the quiz. To simulate a time-pressured, stressful environment, the students were instructed to allocate only 10 minutes for each case. This may help improve the external validity of the study. As participation was voluntary, the students were told that they were free to opt out if desired. To ensure that students from the control group also benefited from this study, feedback was given to this group after they completed the case scenarios.

The responses of the students were evaluated by two assessors, who work as both emergency physicians and senior lecturers. These two assessors performed their evaluations independently and using a marking scheme that was provided. The assessors were blinded to each other's assessment of the students and the group the students belonged to. The average of the marks awarded by these two assessors was used for statistical analysis. In the event that the students gave alternative diagnoses that were not listed in the marking scheme, the assessors used their discretion to decide whether marks should be rewarded or not (Appendix 2).

RESULTS

Inter-rater agreement was good, with intra-class correlation coefficients (ICC) of 0.93 for case 1, 0.86 for case 2, 0.76 for case 3, 0.45 for case 4 and 0.70 for case 5. Overall, students in the intervention group scored higher in all five cases than those in the control group. An independent *t*-test (parametric data with the kurtosis and skewness z-values within ± 1.96 and Shapiro-Wilk test with $p > 0.05$) comparing the aggregate mean scores of the students in all the five cases showed that the scores of the students in the intervention group (mean score: 18.50 ± 4.45 marks, max score: 50 marks) was significantly higher than the scores of the students in the control group (mean score: 12.50 ± 2.84 marks, max score: 50 marks) ($t[38] = 5.01$, $p < 0.001$). This *t*-statistic value is greater than the critical value at a 2-tailed α of 0.05, which is 2.024. Therefore, the null hypothesis was rejected.

Detailed comparisons of the scores for each case are shown in Tables II and III. The comparisons show that the students in the intervention group were able to make better quality clinical decisions than those in the control group in three of the five cases.

DISCUSSION

The results of this study showed that educational intervention in the form of a 90-minute tutorial on cognitive biases and debiasing strategies, including introduction of the TWED checklist, improves the ability of medical students to make better quality clinical decisions.

Although clinicians may try to avoid committing diagnostic errors that result from cognitive biases, this intention may not be translated into an executable goal. To bridge the gap between goal intention and the needed action, Gollwitzer conceptualised the idea of implementation intentions.[(18)] An implementation intention is not the same as a goal intention; it is a predecided measure that allows for the automatisation of goal intentions even in an unfavourable environment (e.g. a busy and stressful environment). For example, if the intended goal is to minimise diagnostic errors secondary to cognitive biases, the implementation intention could be the use of a mnemonic checklist, like the TWED checklist, which is memorable and easily retrievable.

In a favourable clinical environment, metacognition could be executed with relative ease as the clinician can afford the time and effort to do so. However, interruptions are ubiquitous in emergency departments. These interruptions often delay clinicians from executing their intention of re-calibrating their thinking.[(19)] Interruptions impose additional burdens to the cognitive load of clinicians, as they have to switch from one task to another.[(19)] By the time the clinicians return to attend to their first patient after having addressed numerous interruptions, they might be distracted and forget to execute their intention. It must also be emphasised that performing cognitive debiasing does not necessarily translate into eventual improvement in the diagnostic accuracy.[(17)] In fact, in some cases, it can be the contrary.[(17)] Gathering more data may slow down the entire decision-making process unnecessarily and this can be detrimental at times when emergency interventions such as cardiopulmonary resuscitation is urgently called for. This is especially the case if the process of recalling the numerous cognitive biases, identifying the cognitive biases involved and picking the right cognitive debiasing strategy is taxing to the working memory.

In this regard, a mnemonic checklist, such as the TWED checklist, can help clinicians to perform cognitive debiasing after having addressed numerous interruptions (Fig. 2), since it helps to facilitate recall[(20)] by transforming the technical terms of common cognitive biases into a memorable acronym. To be effective, the checklist should be applied after a decision is made rather than before or during the decision-making process.[(21)] This is because upfront application of a checklist increases, rather than decreases, the cognitive load of the decision maker.[(21)] Furthermore, by virtue of the questions posed in the TWED checklist, it is only meaningful to apply the checklist after an initial clinical decision has been made. Applying the TWED checklist is akin to applying the brakes in the fast lane of clinical decision-making. It affords the clinician the opportunity to reflect on the quality of the decision made before moving on to the next case.

The present study employed the quasi-experimental design. Although this may have weakened the internal validity of the data, the knowledge and experience of the students in both groups could be expected to be similar on the basis that they were selected sequentially at the beginning of their Year 5 semester with four equal years of undergraduate experience. Furthermore, in order for them to progress to Year 5, all of the students would have successfully passed the clinical rotations in their Year 4 study and thus, met the minimum standard expected of them. The clinical rotations that the students had gone through include internal medicine, surgery, obstetrics and gynaecology, paediatrics, orthopaedics, and neurology and neurosurgery.

The present study also had four other pertinent limitations that need to be addressed in future research on the TWED checklist. First, the present study's methodology was not designed to objectively demonstrate that the TWED checklist had been used successfully as a cognitive debiasing strategy. Direct laboratory studies on the effects of cognitive debiasing strategies are extremely challenging as it cannot be ascertained whether any of the cognitive biases were committed by the study participants. Only the decision maker would know whether he or she had committed any cognitive biases in his or her train of thought. Even if any of the study participants had committed cognitive biases, admission is highly subjective and contingent to the person's awareness of cognitive biases at the time of the decision-making process.(17) Secondly, the Hawthorne effect should be taken into consideration.(22) The fact that students were aware that they were being observed on how they made decisions after a tutorial session would have alerted them to possible 'traps' in the case scenarios. The challenge therefore is to investigate whether the TWED checklist is able to make a difference in real-time clinical settings where the decision maker is not observed. Third, no matter how vigorous a study's methodology is, any research that is conducted in a classroom setting lacks the ecological validity of a complex clinical setting.[6] Mimicking the real ambient environment of a stressful clinical setting is perhaps the greatest challenge faced by researchers who seek to study cognitive biases.[6] Finally, the present study merely entails the use of a single educational intervention. It is unlikely that a single-shot educational intervention on cognitive debiasing strategies will be effective over a long period of time.[9] People forget. To be skilled practitioners of the TWED checklist, repetitive practice is needed. Clinical decision making is a complex process; experience, expertise and the necessary mindware affect the quality of the decision made.

The question remains on whether the TWED checklist should be used as a sort of ‘cognitive screening tool’ for every single clinical decision made by clinicians. McDaniel et al theorised that constant prolonged exposure to a mnemonic cue offers no advantage (in aiding memory to execute intended actions) over the use of no cue at all.[19] Rather, for the mnemonic to be effective, it should only be used periodically.[19]

In conclusion, the results of the present study support the use of the TWED checklist in facilitating metacognition in clinical decision-making. Despite the limitations of this preliminary study, the results support further investigation on the use of the TWED checklist to facilitate metacognition.

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Table II. Comparison of the mean scores of the intervention and control groups for cases 1, 2, 3 and 5.

Case	Mean score ± standard deviation		Mean difference	95% CI	*t*(df)	p-value	ICC	
	Intervention group (n = 21)	Control group (n = 19)					Intervention group	Control group
1	4.55 ± 1.45	2.21 ± 0.86	2.34	1.55 to 3.12	*t*(38) = 6.021	< 0.001	0.85	0.80
2	3.53 ± 1.85	3.16 ± 1.31	0.37	–0.67 to 1.40	*t*(38) = 0.713	0.48	0.91	0.75
3	4.07 ± 1.16	2.24 ± 0.79	1.83	1.19 to 2.47	*t*(38) = 5.77	< 0.001	0.45	0.68
5	4.07 ± 1.30	2.81 ± 1.06	1.26	0.49 to 2.01	*t*(38) = 3.33	0.002	0.60	0.58

Note: The maximum score for all the cases was 10. Independent t*-test was used for the analysis of mean scores between the two groups, as normality of distribution was assumed. Equality of variances was assumed based on the parametric Levene's test for homogeneity of variance with p > 0.05. Critical value for* t*-statistic at 2-tailed α = 0.05 was 2.024. Intra-class correlation coefficient (ICC) was calculated using average measures and a two-way mixed model with absolute agreement.*

Table III. Comparison of the mean ranks of both the intervention and control groups for case 4 using the Mann-Whitney *U* test.

Group	Median score ± SD	Mean rank for case 4	Sum of ranks	*U*-value	z-statistics	p-value	ICC
Intervention group (n = 21)	2.28 ± 0.70	23.14	486	144	–1.58	0.114	0.64
Control group (n = 19)	2.08 ± 0.51	17.58	334				0.46

Note: The maximum score for case 4 was 10. Mann-Whitney U *test was used as the normality of distribution could not be assumed for case 4 (Shapiro-Wilk's test, p = 0.01). Equality of variances assumed based on non-parametric Levene's test for homogeneity of variance with p > 0.05. The critical* U*-value at two-tailed α = 0.05 was 126. The obtained* U*-value in case 4 was 144, which is > the critical* U*-value (i.e. 126); thus, the null hypothesis was not rejected. Intra-class correlation coefficient (ICC) was calculated using average measures and a two-way mixed model with absolute agreement. SD: standard deviation*

FIGURES

T = life or limb Threat *(What are the life or limb threatening conditions in this patient?)* Rationale: This quadrant encapsulates the rule-out-worse-case scenarios (ROWS) heuristics as a form of cognitive forcing strategy as well as to de-bias anchoring and triage cueing	**W = Wrong?** *(What if I am wrong? What else could it be?)* Rationale: To de-bias search satisficing, anchoring, confirmation, availability biases, etc
E = Evidences *(Do I have sufficient evidences for or exclude this diagnose?)* Rationale: To de-bias anchoring, confirmation bias, blind spot, myside bias, ego bias, etc.	**D = Dispositional factors** *(What are the Environmental & Emotional (2Es) dispositions influencing my decision?)* Rationale: These dispositional factors that may affect our decision making. Examples: Environmental – chaotic, busy working place, Emotional – sleepiness, tiredness, anger

Fig. 1 Diagram shows the TWED checklist and the potential cognitive biases it addresses.

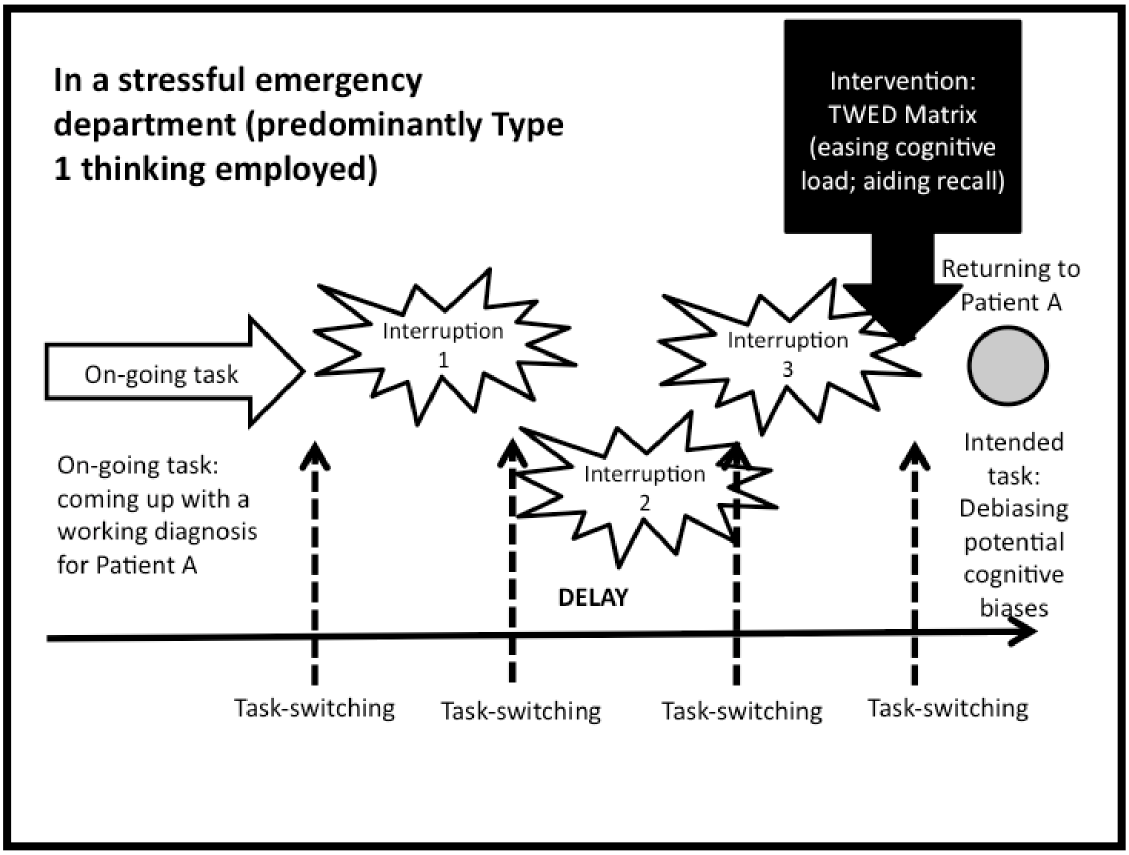

Fig. 2 Diagram shows the difficulties of applying cognitive debiasing strategies in a chaotic emergency department and the point where the TWED checklist can be applied.

APPENDICES

Appendix 1
Outline of case scenarios in assessment tool.

Case	Apparent diagnosis	Potential cognitive biases involved	Second (more serious) diagnosis to be considered	How TWED checklist helps?
1	Anxiety disorder with possible secondary gain, acute gastroenteritis, food poisoning	**Search satisficing:** Participants may be satisfied with the diagnosis of stress-related anxiety disorder and satisfied that the patient was responsive to the intravenous hydration for acute gastroenteritis. Hence, they do not seek further for a second diagnosis.	Acute myocardial ischaemia secondary to cocaine (sympathomimetic) intoxication	***T = What is the life/limb threat in this case?*** History of cocaine ingestion, chest discomfort should alert to the possibility of sympathomimetic-induced myocardial ischaemia. ***D = What are the dispositional factors influencing your decision?*** Emotive disposition: the pestering for medical leave certificate may elicit a repulsive response from the participant.
2	Stress-related tension headache	**Availability bias:** the relationship of neck pain and meningism (irrespective of cause) may not readily come to mind if the participant has not seen or read about meningism. **Search satisficing:** Participants may be satisfied that the pain score improvement	Meningism, secondary subarachnoid haemorrhage	***T = What is the life/limb threat in this case?*** The mere fact that the patient presents to the department in the early hours (3 a.m.) should alert that student that this could be something more sinister than just a tension headache. The quality/nature of the headache as well as the severity of the headache, which is worse compared to previous episodes of headache she has experienced, should

		after medications and seek no further for another possibility.		also alert the participant that this could be a red flag. ***W = What else? What if I am wrong?*** The fact that the patient developed neck pain the following morning is a red flag for meningism.
3	Acute coronary syndrome	**Search satisficing:** participants may be satisfied with the diagnosis of acute coronary syndrome 'inherited' from the paramedic who performs the triage, hence seek no further for alternative diagnosis. **Availability bias:** Participants who only look at the absolute value of a vital sign and are not in the habit of analysing its trend or dynamics by comparing the reading before and after may miss the significant drop in blood pressure. Participants who do not review the medications that the patient is taking (e.g.	Perforated viscus with acute haemorrhage/peptic ulcer bleeding	***T = What is the life threat?*** Epigastric tenderness + hypotension = the need to rule out perforated viscus/peptic ulcer bleeding. ***W = What else? What if I am wrong?*** The absence of appropriate tachycardia does not necessarily mean that the patient is not having acute haemorrhage as he is taking beta-blocker.

		beta-blocker) may miss the masking effect of beta-blocker on the tachycardic manifestation.		
4	Healed compression spinal fracture with osteophytes	**Anchoring and Confirmation bias:** participants who have anchored the diagnosis of healed compression fracture of the spine tend to associate the accident that healed fracture in order to confirm the current back pain that the patient is having. **Search satisficing:** Participants may be satisfied with the diagnosis offered by more authoritative personnel (i.e. the registrar in charge). **Availability bias:** Participants who are not in the habit of actively trying to correlate the clinical finding with the apparent abnormality	Acute progressive paraplegia from T10 level that demands further in-hospital investigations	***W = What else? What if I am wrong?*** The discrepancy between clinical finding and radiologic finding should demand a re-assessment. ***E = Do I have sufficient evidences to support this diagnosis?*** Again, if the participants slow down and attempt to correlate the clinical findings with the radiologic findings, there is no evidence to suggest that the current complaints of the patient are due to the L1 lesion.

		found on radiograph may miss the discrepancy between the sensory loss at the level of umbilicus (T10) with the L1 findings on radiograph.		
5	Mild head injury	**Search satisficing:** Participants may be satisfied with the negative findings on skull radiography and her full Glasgow Coma Scale scores; hence, they do not investigate further. **Confirmation bias:** Participants who have anchored the diagnosis of mild head injury may look for the negative skull radiograph to confirm their suspicion.	Headache, repeated episodes of vomiting are red flags to perform a head computed tomography especially for an elderly patient	***T = What is the life threat?*** Headaches + repeated episodes of vomiting + physiological/ anatomical changes of the elderly = red flags for traumatic intracranial bleeding.

Appendix 2

An example of case scenario in the assessment tool.

Case scenario 1

A man in his 20s presents to an emergency department complaining of acute shortness of breath and central chest discomfort for three hours prior to arrival. He appears anxious, sweaty and feverish. He has two episodes of diarrhoea and vomiting the night before, claiming that it could possibly be due to the curry noodle that he ate. He says that his assignment deadline is due in three days' time and he requests that the doctor gives him a one-day medical leave.

His initial vital signs are: blood pressure 140/90; pulse rate 140/minute; temperature 39°C; and respiratory rate 30/minute. The paramedic at triage counter tags him with a diagnosis of 'acute gastroenteritis' and treats him with 600 cc of 0.9% normal saline.

About half an hour later, when asked by the attending doctor, the patient says that he had a drink with his friends at a nightclub "just to unwind from the stress of his job." He admits to have consumed cocaine pills during the party. He also admits that he consumes cocaine "on a regular basis".

Except for mild chest discomfort, he says that he feels much better after the intravenous hydration and impatiently pesters the doctor to discharge him with a one-day medical leave. The doctor finds no significant findings on physical examination.

Questions:

1. If you were the attending doctor, would you have discharged him with a one-day medical leave certificate? Why or why not? (Total marks: 7)

Marking scheme:

- Not for discharge yet (1 mark)
- Give reason(s): e.g. persistent chest pain (1 mark), need to rule out coronary event (1 mark)
- Give rationale/explanation: because of ingestion of cocaine (1 mark), cocaine results in catecholamine surge (1 mark); resulting in sympathetic over-activity and coronary artery vasoconstriction and spasm (1 mark)
- What needs to be done: at least an electrocardiograph (1 mark)

Note: No mark to be rewarded for this question if the student agrees to discharge the patient at this juncture without further investigation.

2. List the diagnoses you should consider for this patient. (Total marks: 3)

Marking scheme:

- Myocardial ischaemia/infarction (1 mark)*
- Acute gastroenteritis (1 mark)
- Anxiety disorder/malingering (1 mark)

*May include other diagnosis that could be reasonably considered in this case. 'Myocardial ischaemia/infarction' must be included as an answer; otherwise, a maximum of 2 marks will be awarded.