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Quality and Safety Learning Corner

Adopting the "TDODAR" Model to Improve Clinical Decision-Making in Acute and Critical Care Settings

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LEARNING OBJECTIVES

1. Explain the TDODAR (time, diagnosis, options, decide, act or assign, review) decision model, which was originally intended for use in the aviation industry.
2. Discuss how the TDODAR decision model can be applied in clinical settings to improve quality of decision-making under stressful and time-sensitive situations.
3. Understand the prevalence of diagnostic and decision errors in clinical practice, their implications on patient safety, and major contributors to poor clinical judgment.

INTRODUCTION

Diagnostic and decision errors are prevalent problems in medical practice,[1,2] estimated to occur in 8–15% of hospital admissions,[3] with significant diagnostic discrepancies found in 10–20% of autopsy cases.[4] In a large cohort study performed on 2428 adult patients at 29 hospitals in the United States who were either transferred to intensive care unit or died, it was reported that 23% of cases involved a diagnostic error, of which nearly 80% were associated with temporary or permanent harm or even death.[5] Broadly, major contributors to clinical decision-making errors can be classified into cognitive factors (e.g., inappropriate clinical reasoning, cognitive biases, inaccurate collection and synthesis of clinical information) and external factors (e.g., harsh working environment, time or manpower constraints, stress and fatigue).[2] It is known that diagnostic errors are rarely due to a lack of medical knowledge, but rather more commonly caused by poor clinical judgment due to flaws in cognitive reasoning and information processing.[3] In acute and critical care settings, there is a propensity for diagnostic errors due to the nature of clinical cases (e.g., complex cases, critical illness, uncooperative or uncommunicative patients), heavy caseload with rushed handovers, repeated interruptions or distractions and other psychoemotional stressors.[3,6]

For many years, the aviation industry has been seen as an archetypal model of safety standards from which the healthcare sector should learn, given that both are high-stakes industries where errors can be costly and lead to fatality.[7] As such, aviation safety measures such as safety checklists, skills and simulation training, improving teamwork and communications, and incident reporting and analysis have progressively been adopted in healthcare settings.[7] In this article, I explain how the TDODAR (time, diagnosis, options, decide, act or assign, review) decision model,[8] (Table 1, Figure 1) which was originally developed to deal with in-flight emergencies or troubleshoot problems in the aviation safety industry, can be adopted in high-risk clinical settings to streamline clinicians thought processes, avoid cognitive errors, and ensure timeliness of decision-making for patient safety.

TDODAR DECISION-MAKING TOOL

The TDODAR decision model comprises six sequential steps: 1) time, 2) diagnosis, 3) options, 4) decide, 5) act or assign, and 6) review.

Step 1: Time

When faced with a stressful or high-risk clinical situation (e.g., handling deteriorating or critically ill patients, heavy workload with severe time constraints, multiple distractions, and competing tasks), always make it a point to assess the amount of time that is available to deal with the problem(s) at hand – i.e., make an assessment of the

Table 1. Practical example of TDODAR decision model in clinical practice

Scenario	An on-call house officer (HO) is called by the nurse to see a patient with fever and hypotension. This patient is a 65-year-old gentleman, with background of diabetes mellitus, now admitted for 1-week duration of painless, obstructive jaundice. The primary team has planned for the patient to undergo cross-sectional imaging to evaluate for periampullary lesions (e.g., head of pancreas tumor).
Time	The junior HO has a list of patients that he needs to review on call. He clicks through the patient's clinical records and vital signs—the patient has high fever (39.5°C), blood pressure 80/45 mm Hg, and NEWS score of 7. In view of unstable parameters, the HO prioritized this case and quickly went to review patient. On examination, the patient appeared lethargic, his abdomen was soft but mildly tender, and mucosa was dry. The HO correctly recognized that this is a "sick" patient with severe sepsis who is hemodynamically unstable and whose condition can deteriorate rapidly.
Diagnosis	Using a hypothetico-deductive approach based on the patient's presentation and clinical history, the HO quickly came up with reasonable differential diagnoses for patient's case, including sepsis secondary to cholangitis/pancreatitis or other intra-abdominal sources, with hypotension possibly contributed by both sepsis and hypovolemia.
Options	In terms of investigations, laboratory tests could be sent including full blood count, inflammatory markers, liver function tests, amylase/lipase, and blood cultures, however with turnaround time of 1–2 hours for most of the tests and longer duration for blood cultures depending on what (if any) pathogens are identified. Imaging modalities may include a portable CXR to look for pneumonia, and an urgent CTAP, which may help clinch diagnosis of intra-abdominal source of sepsis. However, the patient is presently hemodynamically unstable, so it would be safer to fluid resuscitate and stabilize his condition before transfer for any CT scans. Lastly, in terms of definitive procedures, if the patient does have acute cholangitis due to obstructive lesion, early ERCP with sphincterotomy/stent placement may be considered for biliary decompression. However, this patient is presently hemodynamically unstable to undergo a procedure under moderate sedation, and moreover, the logistics and personnel needed to perform urgent ERCP overnight would require further discussion and special arrangements.
Decision	The HO weighed the options available and decided to send off blood tests, order a portable CXR, and commence empirical broad-spectrum antibiotics and intravenous fluid boluses. He promptly escalated the case to the senior HO on call who also informed the medical registrar of this patient with actively deteriorating condition. After reviewing the patient, the medical registrar decided that patient should be stabilized after prompt initiation of fluid resuscitation and broad-spectrum antibiotics, and keep in view CTAP scan once patient's hemodynamics are stabilized.
Act/assign	The medical registrar then delegated the roles according to the management plan—for the nurses to monitor patient's vitals and I/O closely (at least hourly), prepare medications, and keep patient nil by mouth; for the junior HO to take the blood samples and cultures quickly, insert an indwelling catheter for strict I/O charting, and subsequently call the on-call radiologist for approval of CT scan; for the senior HO to contact patient's family and re-assess patient overnight and keep the registrar updated of patient's progress.
Review	After the patient received the first dose of intravenous meropenem and a total of 1.5 L of fluid boluses, he appeared clinically improved, with latest blood pressure 100/60 mm Hg. The on-call senior HO reviewed the patient and deemed him to be suitable for transfer to the scan room for urgent CTAP. After the scan was done, patient was transferred back to the ward uneventfully. Laboratory markers came back with severely deranged liver enzymes and significantly elevated amylase/lipase levels. The scan was preliminarily reported as suggestive of acute cholangiopancreatitis in the given clinical context, with a large mass at the head of pancreas worrisome for malignancy. An hour later, when the patient was re-reviewed again for recurrent hypotension, he was in need of another 1 L in fluid boluses. The senior HO then promptly updated the medical registrar of clinical progress. Upon discussion with the ICU team and on-call endoscopic procedurist, they came to a decision that patient should be transferred to the medical ICU for closer hemodynamic monitoring, keeping in view inotropic support overnight, with plans for early ERCP tomorrow when patient is stabilized. The patient was transferred to the ICU and single-agent inotropic support was subsequently commenced. The following day, both gastroenterology and hepatopancreatobiliary surgical teams were referred. Patient was planned for bedside ERCP with stent insertion for biliary decompression, and staging scans and preoperative planning if deemed suitable for Whipple procedure for pancreatic malignancy.

CT: computed tomography; CTAP: computed tomography abdomen/pelvis; CXR: chest x-ray; ERCP: endoscopic retrograde cholangiopancreatography; ICU: intensive care unit; I/O: intake/output; NEWS: National Early Warning Score.

urgency and severity of the clinical situation. Initial triaging to determine which patient needs urgent review can quickly be done, based on the clinical presentation (takes clinical acumen and experience), hemodynamic or vital parameters, and simple prognostic tools such as the National Early Warning Score (NEWS) or NEWS 2 score.[9] Subsequently, during the actual clinical review, consider whether the patient's condition appears to be actively deteriorating and if so, estimate the expected clinical trajectory (e.g., Is there time to comprehensively evaluate or diagnose this patient or is acute resuscitation, stabilization, and escalation of care more crucial at this juncture?). In addition, consider if there is a life-threatening condition or medical emergency that must be ruled out immediately (e.g., Could a patient with severe, sudden-onset chest pain have aortic dissection?).

Step 2: Diagnosis

In clinical practice, a hypothetico-deductive approach is often used to quickly generate plausible differential diagnoses shortly into the clinical consultation, which helps to guide subsequent targeted examination and investigative workup that will rule in or rule out individual diagnostic possibilities. Importantly, reaching a diagnosis is sometimes not, by itself, sufficient, as certain conditions have underlying causes, triggers and associated

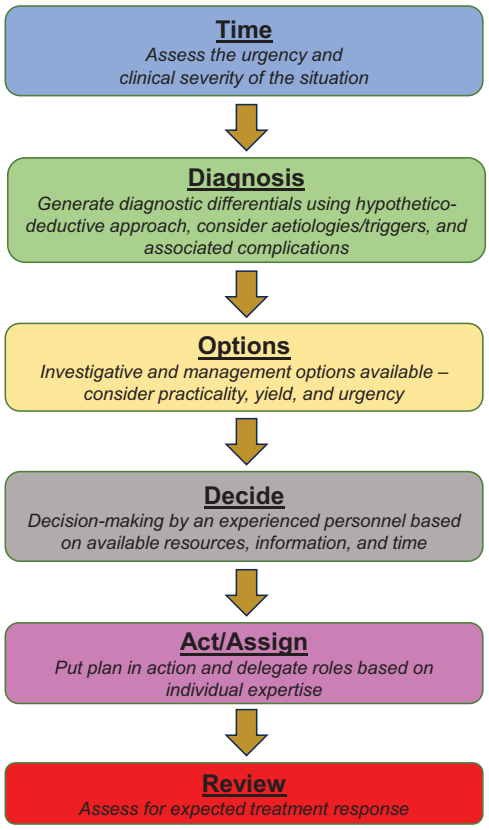

Figure 1. Flowchart showing the TDODAR model for clinical decision-making.

complications that all need to be addressed appropriately in a timely fashion. For example, a patient with acute decompensated heart failure may have been tipped over by an underlying chest infection, which can be further complicated by respiratory failure that may require noninvasive or invasive ventilator support.

Step 3: Options

Having made an initial clinical assessment (of the severity and urgency of the problem) and generated plausible differential diagnoses, it is then important to determine carefully the subsequent management options (i.e., choice of investigations [if any at all], administration of empirical or definitive treatment). Firstly, consider the expected yield of the investigative modalities, based on pretest probabilities and diagnostic accuracy (i.e., sensitivity and specificity). For example, a D-dimer test is known to be useful to rule out a pulmonary embolism (PE) in a low pretest probability situation, but is wholly inappropriate to be used in a patient with high clinical suspicion of PE. In addition, consider if the evaluations planned will likely change the clinical trajectory or management, depending on the patient's goals of care. For example, in an older person with advanced dementia and poor premorbid function who is now admitted for severe pneumonia, it would be appropriate to discuss the extent of care, and consider if investigations such as arterial blood gas is necessary and likely to change clinical management if the patient is deemed not to be suitable for higher levels of ventilator support (e.g., mechanical or noninvasive ventilation).

Secondly, weigh the expected benefit and clinical yield of the investigative options against the risks incurred, turnaround time expected, and availability of personnel and resources to carry out the requested investigation or procedure. For example, during overnight calls, there may be limited manpower and resources available to perform scans or procedures. In addition, for patients in an unstable condition with high cardiopulmonary risk profile, interventions requiring sedation may be preferably deferred till the next working day when the patient is stabilized, optimized and more experienced personnel and support is available.

Thirdly, consider if the clinical context might warrant initiation of empirical treatment (i.e., either without performing investigations or before investigation results are reported). For example, it may be prudent to transfuse blood products empirically in an actively bleeding or hemodynamically unstable patient instead of awaiting the full blood count to be formally reported by the laboratory. Likewise, septic shock needs to be identified early and treated with empirical antibiotics, which can later be adjusted to culture-directed therapy.

Step 4: Decide

Clinical decision-making should be made by an experienced or qualified individual who can take responsibility for the decision, act on and delegate roles accordingly. When in doubt, or in emergency, life-threatening or complex situations, the decision-making should be escalated to a senior physician. In fact, when certain important clinical decisions (such as major procedures or surgeries, ceiling of care) need to be made in the best interest of a mentally incapacitated patient (especially if there is no available surrogate), it may be necessary to involve more than one senior physician in the decision-making process. In real-world settings, decision satisficing may be required owing to limited time, information, and resources available. When there are clinically contentious situations, decision-making may take into account the "reasonable" doctor (i.e., Bolam-Bolitho) or "reasonable" patient (i.e., Modified Montgomery) standards,[10] which are medicolegal frameworks applied to judge medical negligence.

Step 5: Act/Assign

After a management strategy has been decided on, the next step is to act on the clinical plans and delegate roles appropriately. For instance, in advanced cardiac life support for code blue situations, it is necessary to have a resuscitation leader and proper delegation of various tasks (chest compressions, airway and ventilation, medication preparation) for good team performance. In other situations, such as clinical reviews of patients with deteriorating conditions, roles may be delegated to

various medical, nursing and allied health staff, based on individual expertise (e.g., a more senior doctor may be tasked to break sensitive or bad news to a patient's family, a less experienced junior doctor may be asked to arrange for scans or perform blood taking, and nurses may be asked to prepare medications and perform vitals' monitoring).

Step 6: Review

In both clinical diagnostics and management, after the relevant investigations have been performed and treatments administered, it is crucial to review and re-assess in a timely manner if the initial clinical impression was correct and the management strategy appropriate. For example, in a critically ill patient with septic shock who has been given fluid boluses, it is necessary to re-assess the patient at regular intervals for hemodynamic response and fluid responsiveness through static/dynamic measures. Such clinical reviews and repeated assessments are crucial to determine if the patient would benefit from persisting with the same treatment/intervention or require a timely change in strategy (for instance, switching to inotropic support).

CONCLUSION

In summary, the TDODAR decision model is a potentially useful tool in hospital medicine, particularly in high-risk acute and critical care settings that predispose to diagnostic and management errors with serious repercussions in patient care/safety.

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