Studies have shown that as many as one in four consultations in primary and ambulatory care result in harm to patients from clinical errors (Auraaen et al, 2018). Until recently, the emphasis has been on identifying and reducing the risk of errors in the treatment of patients, even though errors in diagnosis are twice as common as treatment errors and result in greater harm to patients. This is mainly because it is easier to identify the cause of treatment errors and to develop strategies and interventions to either prevent or detect these errors. Making a diagnosis is a complex process and the causes of errors are many and varied. Introducing patient safety-focused interventions into the diagnostic process is, therefore, much more challenging. Similarly, considerable time is devoted to training both students and staff in how to prevent and detect treatment errors, whereas little, if any, teaching is delivered in either undergraduate or postgraduate education on applied diagnostic reasoning and how to prevent and detect diagnostic errors. However, since 80% of diagnostic errors are considered to be preventable, there is a significant opportunity to reduce the risk of harm to patients by introducing measures to prevent and detect diagnostic errors.

The World Health Organization (WHO) (2011) has recommended that greater emphasis is given to patient safety training, and in 2016 it produced a series of technical monographs on Safer Primary Care, including one on Diagnostic Errors (WHO, 2016: 9), where it stated that:

‘Trainees would benefit from explicit training in clinical (diagnostic) reasoning, patient safety, human factors, critical thinking, managing uncertainty, cognitive heuristics and biases, test limitations, probability concepts, reliability science and systems thinking. Training focused on the causes and impact of diagnostic error might help providers become more competent in error prevention.’

Auditing the measures taken to reduce treatment errors has shown that education on the causes of error needs to be supported by other strategies and interventions if the risk is to be reduced, and the same applies to diagnostic error prevention (Health Research and Educational Trust, 2018). A multifaceted approach to the prevention and detection of diagnostic errors is required, which should start in the classroom and continue through to the consulting room.

One of the methods that has been employed successfully to reduce treatment errors is checklists, which are now used routinely to prevent and detect errors in clinical practice. Recently, checklists have also been developed to reduce the risk of diagnostic errors (Ely et al, 2011), including one that is used in emergency departments in the US (Grabter et al, 2014). Although the causes of diagnostic error are varied, they can be grouped into those that involve knowledge deficits, such as not acquiring, organising or mobilising the clinical knowledge required to make the correct diagnosis; over-reliance on intuition and memory during the diagnostic reasoning
process; errors in cognition, such as failed heuristics (mental shortcuts) and cognitive biases (factors that influence the way in which problems are solved by the individual); cognitive impairment (impaired thinking and information-processing) and errors in the gathering, transfer or communication of information. The challenge has been to find a way of bringing this diverse group of causes together in a way that trainees can easily learn and clinicians can readily apply.

This article describes a checklist mnemonic, SAFER PRACTICES (Box 1), which covers the main causes of diagnostic error in primary and ambulatory care. It is designed for use both in the classroom and the consulting room in an integrated approach to reducing the risk of diagnostic error. In the classroom, it can be used to emphasise the need to adopt a symptom-based, patient safety-focused approach to acquiring and organising the clinical knowledge that is required to make a diagnosis, as well as to teach students the importance of developing a sound system of diagnostic reasoning. In clinical practice, it can be incorporated into consultations to help prevent diagnostic errors and when reviewing or reflecting on consultations.

Preventing/detecting knowledge-related errors: SAFER

A major cause of diagnostic error involves not considering the correct diagnosis in the list of potential causes for a symptom during the diagnostic reasoning process. This can be due to having not:

- Acquired the relevant knowledge to link the correct diagnosis to the symptom
- Organised that knowledge in a way that links the correct diagnosis to the symptom
- Recalled that knowledge when prompted to do so by the presence of the symptom

The first part of the mnemonic, SAFER, aims to reduce the risk of diagnostic errors due to knowledge-related errors and works best when it is used in both the classroom to ensure that the correct information is learned and that it is organised well and in the consulting room to check that the correct information has been applied in the diagnostic reasoning process.

In primary and ambulatory care, patients present with a symptom, not a diagnosis, so it is essential for safe practice that trainees adopt a symptom-based, patient safety-focused approach to their learning, as well as in clinical practice. Without this critical information, diagnostic error is inevitable. The first step in reducing the risk of diagnostic error, therefore, begins in the classroom, not the consulting room. Adopting a symptom-based, patient safety-focused approach to learning involves creating a list of the common symptoms encountered in the individual’s workplace and writing down the names of the serious ‘must-not-miss’ illnesses that are associated with that symptom (Newman-Toker et al, 2013).

The next step is to write down not only the more common, ‘obvious’ causes of that symptom, but also the commonly missed, alternative causes that should always be considered.

Next, the typical, atypical and early patterns of illness need to be learned, along with the red flag warning signs and risk factors for these illnesses. This information can be incorporated into a checklist of illnesses to consider and exclude for each symptom, along with key findings to check for, proactively, in a patient presenting with this symptom. The checklist can then be stored in hard copy, or as a computer programme tag, or alert, that is linked to a symptom entry. In clinical practice, SAFER, can be used both during the consultation and for reviewing, or reflecting on consultations later.

The first rule in consulting safely is to ‘exclude the worst, first’, in terms of excluding the serious illnesses associated with the presenting symptom (Silverston, 2014a). It is important to proactively check for the red flag warning signs that indicate the patient is ‘big sick’ now, along with the risk factors that increase the potential for the patient to become ‘big sick’ later.

The next step is to consider the less obvious, alternative causes for the patient’s symptom, as some symptoms, such as shortness of breath, have many different causes, arising in different body systems and

**Box 1. SAFER PRACTICES**

- **S** = Serious. Have I excluded the serious, must-not-miss, causes for this symptom?
- **A** = Alternative. Have I considered the less obvious, alternative causes for this symptom?
- **F** = Fit. Have I checked to see if there are any findings that do not fit with this diagnosis?
- **E** = Early. Have I considered an early/atypical presentation of a serious illness?
- **R** = Risks. Have I checked for the red flags and risk factors for a serious illness?
- **P** = Problem. Have I checked whether this was a problem consultation?
- **C** = Cognitive errors. Have I checked for cognitive errors?
- **T** = Thinking errors. Have I checked for errors that affect thinking?
- **I** = Information errors. Have I checked/critically evaluated all the information available?
- **C** = Checklist check. Have I checked my personal risk assessment checklist?
- **E** = Equivocal. Is this an equivocal/uncertain diagnosis?
- **S** = Safety. Have I double-checked that the patient and their diagnosis are safe?
from different disease processes. Studies have shown that the most frequently missed or misdiagnosed illnesses are common illnesses that have the potential to present early, or atypically, in primary care. Patients with serious illnesses, such as sepsis and invasive meningococcal disease may present early with non-specific symptoms, but subtle, early warning signs or risk factors may be present and other serious illnesses, such as cancer, heart attacks, strokes and pulmonary emboli may present atypically.

**Diagnostic reasoning**

Diagnostic reasoning involves what is known as dual process thinking, which is a combination of type 1 thinking (faster, subconscious, automated thinking) and type 2, (slower, more analytical, methodical thinking). A useful summary of this model as it applies to medicine has been produced by Norman et al (2017). Type 1 thinking often involves the use of mental shortcuts and the application of previous clinical experience of the ‘obvious’ cause of the patient’s symptom. This can result in a diagnosis being made too early in the diagnostic-reasoning process, before all the information has been gathered and analysed. Subsequent information gathered that challenges the assumed diagnosis is then given little weight, or is ignored. This is why it is necessary to check that all the findings that have been gathered during the clinical assessment fit with the pattern of illness for the diagnosis that has been made. A finding that does not fit with this diagnosis should lead to the diagnosis being challenged and an alternative diagnosis in which the findings all fit being considered instead.

**Preventing/detecting cognitive errors: PRACTICES**

Diagnostic reasoning is a highly complex mental process, which can be influenced by factors that affect our ability to think rationally and to process information logically. The second word in the mnemonic, PRACTICES, refers to the human and system factors that can influence the way in which we think and reason.

In the classroom, the mnemonic can help facilitate a better understanding of applied diagnostic reasoning and how errors in this process can result in misdiagnosis and incorrect treatment decisions. In clinical practice, it can be used to help increase awareness of the risk factors that may be present for diagnostic errors to occur and to encourage both critical thinking and reflective practice when considering the potential for these errors during and after the consultation.

‘Problem’ consultations are those in which there is known to be a higher risk of diagnostic error. This includes consultations that involve friends, family and colleagues, or with patients who engender negative feelings during the consultation, as the health professional’s ability to be objective can be influenced by the way that they feel about the patient. Consultations in which the assessment or management of the patient is shared between clinicians can also result in problems from misunderstandings and miscommunication between those involved in the care of the patient and in taking overall responsibility for the patient. External factors in the workplace can also affect the diagnostic reasoning process, such as having insufficient time to assess patients and to reflect on diagnoses between patients. ‘Problem’ consultations should also include clinical situations in which the risk of diagnostic error is higher, such as patients with complex medical problems and multimorbidity; as well as those where the risk comes from the clinician being asked to practice outside their area of competence.

Re-assessment of the diagnosis is required whenever a patient returns for a second time during the same episode of an illness, especially if the symptoms have worsened, or if new symptoms have developed; if the illness has not resolved within the expected time; or if it has not responded to treatment. These are all markers that the original diagnosis may not be correct and that a re-assessment of the diagnosis is required. Similarly, if the diagnosis was suggested by the patient, a relative, or by a colleague, it is important that you assess the patient yourself and check for any findings that are not consistent with that diagnosis.

Information-processing is dependent on the quantity, quality and validity of the information that has been gathered. Errors can arise during the assessment of the patient, which can result in an error in the diagnosis. The ability to perform a competent and safe clinical assessment is a function of the knowledge, skills and experience of the clinician, as well as the time available to perform that assessment. Any limitations on this can have an impact on the information that is gathered and available for use in the diagnostic reasoning process. The relationship between illness, time and clinical assessment may mean that when the patient presents during the early stages of an illness the diagnostic findings may not have developed and the resultant negative findings may be applied during the diagnostic reasoning process to falsely exclude the presence of a more significant illness, or an alternative diagnosis.

There are many different types of cognitive errors, many of which relate to specific parts of the diagnostic reasoning process. Learning how we think and reason during the diagnostic reasoning process promotes a better understanding of not only how a diagnosis is formulated, but also of how errors can arise within this complex process (Royce et al, 2019). It is important to learn how to develop and apply a system of diagnostic reasoning from the outset that does not include faults and avoids acquiring new faults. Faulty heuristics and cognitive biases influence the way in which information is gathered and processed, but can
be countered by using a systematic approach in the prevention and detection of the resulting errors.

Whereas cognitive errors tend to arise from systemic errors in problem-solving, ‘thinking’ errors, are more transient in nature, but just as likely to result in a diagnostic error. Distractions and interruptions to the consultation, along with tiredness, stress, illness, or mood disorders can all lead to diagnostic errors through cognitive impairment. Cognitive overload can occur when patients present with multiple symptoms, or when consultations are too short to allow effective information-processing, or too frequent to enable time to reflect on diagnoses between consultations.

Information errors can arise in a number of different clinical and administrative situations. Incorrect information may be provided by a patient, relative, or by another health professional, so it is important to evaluate the information that is gathered from these sources. Information that is provided in a referral letter and during the patient hand-over tends be highly-selective and biased towards supporting the diagnosis that has been made, so it is important to evaluate this information in this context. Information that could change the diagnosis may be held by different healthcare providers, so it is important to check whether other information is available and to access this, including information on investigations and treatment plans. Making the correct diagnosis may depend on of the reliability and validity of the result of an investigation, or on its interpretation in the context of the patient’s symptoms. Administrative errors may involve information not being documented, or transferred into the patient’s medical records, or the patient not being followed-up.

It is important to create a personalised checklist based on a risk assessment of the both the person and their workplace, with specific questions that relate to both. The checklist for someone working in primary care would be different from someone working in a hospital clinic, or in an emergency department. Checking the checklist of specific questions related to the individual and their workplace is important when a potential source of diagnostic error has been identified, especially if there have been ‘near-miss’ significant events associated with a recurrent error. An example of the types of questions that could be included are shown in Box 2.

Clinical assessment is not a perfect tool and at the end of the consultation it may not be possible to make a certain, unequivocal diagnosis, especially when the presenting symptom is common to many different illnesses, or when the patient presents during the early stages of an illness. When the diagnosis is equivocal/uncertain, there is always the risk that a serious illness is present, which cannot be diagnosed at the point in time that the patient is assessed.

Box 2. Personal checklist questions

**Diagnosis-related**
- Have I checked for these serious illnesses with this symptom in this patient?
- Have I checked for these alternative diagnoses with this symptom in this patient?
- Have I checked for these early/atypical presentations of serious illness in this patient?
- Have I checked whether there are any findings that do not fit with a typical pattern of minor illness, or chronic illness exacerbation in this patient?

**System-related**
- Has this clinical assessment been compromised by time, or for any other reason?
- Has this patient been handed-over to me, or partly-assessed by someone else?
- Has the patient been seen previously by me, or by someone else for the same problem?
- Has the patient failed to respond to treatment?
- Have I reviewed/critically evaluated all the information available to me?

**Cognition-related**
- Am I cognitively impaired today?
- Was I interrupted/distracted during this consultation?
- Was I cognitively overloaded in this consultation?
- Did my relationship to this patient impair my ability to assess them objectively?
- Have I checked for a faulty shortcut or cognitive bias in this diagnosis?

Recognising the potential for diagnostic uncertainty and managing it safely is an essential part of safe practice (Silverston and Stewart, 2014). The safe management of diagnostic uncertainty includes involving a clinician with more specialised knowledge, skills or experience in the diagnostic process, or involving the patient in the diagnostic process by providing them with safety-netting information and the opportunity to return for a re-assessment of the diagnosis should the criteria be met (Silverston, 2014b).

At the end of the diagnostic reasoning process a number of clinical decisions will need to be made, the most important of which is whether the patient is ‘big sick’ now, or at risk of becoming ‘big sick’ later. Patient safety must be placed at the heart of this decision-making process. It is important to review the information that has been gathered and the way in which it has been processed to ensure that the correct diagnosis and clinical decision have been made and
Diagnostic error is a common cause of harm to patients and is preventable in over 80% of cases. The World Health Organization has recommended that all health professionals receive formal training in the diagnostic reasoning and the causes of diagnostic error. Preventing and detecting diagnostic errors requires an integrated approach that starts in the classroom and continues through to the consulting room. Checklists can help reduce the risk of diagnostic error, especially when they are incorporated into both teaching and clinical practice. This article describes SAFER PRACTICES, a mnemonic checklist that can be used in both teaching and clinical practice to prevent and detect diagnostic errors.

**Key Points**
- Diagnostic error is a common cause of harm to patients and is preventable in over 80% of cases.
- The World Health Organization has recommended that all health professionals receive formal training in the diagnostic reasoning and the causes of diagnostic error.
- Preventing and detecting diagnostic errors requires an integrated approach that starts in the classroom and continues through to the consulting room.
- Checklists can help reduce the risk of diagnostic error, especially when they are incorporated into both teaching and clinical practice.
- This article describes SAFER PRACTICES, a mnemonic checklist that can be used in both teaching and clinical practice to prevent and detect diagnostic errors.

**CPD reflective questions**
- What factors are involved in making a diagnosis?
- What are the common causes of diagnostic errors?
- Why is it important to adopt a symptom-based, patient safety-focused approach when learning about the causes of a symptom?
- How could you embed the checklist SAFER into your consultations to detect potential diagnostic errors?
- How could you use the checklist PRACTICES to help you assess and reduce the risk of diagnostic error in your workplace?

In the classroom, they will not be able to apply this knowledge to the patient’s symptoms in the consulting room. This is why an integrated approach to teaching and clinical practice is required. One of the interventions that has proved effective in reducing treatment errors is the use of checklists. Embedding a checklist into the diagnostic process can also help to both prevent and detect diagnostic errors. It can be referred to at the beginning of each clinical session, like a ‘pre-flight’ checklist, to assess the risks that might be present in the individual, or in their workplace and again at the end of the session, as part of reflective practice. It can also be used during the consultation, either selectively, or routinely, to facilitate critical thinking during the diagnostic process. The checklist mnemonic SAFER PRACTICES can be used both in the classroom and the consulting room to reduce the risk of diagnostic error from a number of different causes and has the potential to reduce the risk of harm to patients.