**SAFER PRACTICES: Reducing the risk of diagnostic errors**

**Introduction**

Over the past decade, a number of studies have been published which have highlighted the problem of diagnostic error in primary and have sought to quantify the frequency with which errors occur and to determine the causes of these errors (Newman-Toker et al, 2013. Singh et al, 2017). Diagnostic errors are relatively common in primary care and they often result in serious harm being caused to patients, such that if diagnostic error was considered to be a disease, it would be ranked as the 14th highest cause of death (Auraaen et al, 2018). Of particular note is that it has been estimated that up to 80% of diagnostic errors are avoidable. In 2016, this led the World Health Organisation (WHO) to declare that reducing the risk of diagnostic errors in primary care should be considered a global priority and that “Training focused on the causes and impact of diagnostic error might help providers become more competent in error prevention” (WHO, 2016).

Errors in diagnosis have many different causes, a multi-faceted approach to the prevention and detection of diagnostic errors is required (Health Research and Educational Trust, 2018). In the aviation industry, checklists are used routinely to prevent or detect system and human errors, as pre-flight, in-flight and post-flight checks and there are also checklists available to be used in emergency situations. The same approach has been adopted in the operating theatre to reduce the risk of treatment errors, where checklists have been embedded into treatment plans to both prevent and detect treatment errors. Diagnostic error checklists have been developed (Ely et al, 2011) and used in the Emergency Department (Graber et al, 2014). This article describes a mnemonic-based approach, SAFER PRACTICES (see Box A), which is designed to be used both as diagnostic checklist during the consultation but also as part of a system to help practice nurses develop the medical knowledge, clinical assessment skills and diagnostic reasoning capability required to avoid diagnostic errors in primary care and to apply reflective practice and critical thinking to the diagnostic process (Silverston, 2019).

**Pre-Consultation**

Although many doctors and nurses spend much of their working day making diagnoses, it is surprising how little time is devoted during their training to learning about the diagnostic process itself and the causes of diagnostic error. SAFER PRACTICES is based upon a very simple concept, which is that in order to make the correct diagnosis you need to possess and apply the correct medical knowledge, to the correct quantity and quality of information gathered during the clinical assessment of the patient, using a correctly-functioning diagnostic reasoning system. Errors in diagnosis then become a function of not acquiring, organising, or recalling medical knowledge; not gathering the correct information during the clinical assessment, or not assessing the diagnostic quality of that information; or, they occur as a result of a diagnostic reasoning system dysfunction, or a transient malfunction. It also highlights the fundamental importance of pre-consultation learning and preparation in reducing the risk of diagnostic error, as coming to the consultation without the necessary medical knowledge, clinical assessment skills and diagnostic reasoning abilities increases the risk of making a diagnostic error. Conversely, it emphasises the need to always practice within one’s area of medical knowledge and within the limits of one’s clinical assessment and diagnostic reasoning abilities.

Use of the mnemonic pre-consultation can help to bring a symptom-based, patient safety-focused approach to the way that practice nurses acquire, organise and prioritise their medical knowledge to avoid diagnostic errors from knowledge deficits and from not recalling medical knowledge in the appropriate clinical situation. Similarly, it can be used in the preparation of a toolbox of symptom-based, patient safety-focused clinical assessments that are specifically designed to ensure that the relevant diagnostic information required to establish the correct diagnosis is gathered and that diagnosis-related medical knowledge is recalled. Finally, the mnemonic can also be used to help practice nurses understand the causes of diagnostic reasoning errors, so that dysfunctions within the reasoning system can be identified and corrected and the risk of transient reasoning malfunctions can be reduced through increased self-awareness and changes to working practices.

In primary care, patients present with a symptom, not a diagnosis, so it is important that a symptom-based approach is taken to the way that medical knowledge is acquired and organised. This can be achieved by creating a list of the symptoms that patients present with most commonly and then under each symptom heading writing down a list of the causes for each symptom. The list may vary from practice nurse to practice nurse, as some practices limit the scope of practice for their practice nurses to not seeing babies and young children, or to seeing patients with a restricted list of symptoms. It is important that this is taken into account when creating these lists, as the serious illnesses associated with a particular symptom may vary with the patient’s age, gender, or other demographics.

The next step is to bring a patient safety focus to this list by re-organising it, so that the serious causes for each symptom appear at the top of the list (Newman-Toker et al, 2013). These are the serious, “must-not-miss” causes referred to in the mnemonic and represent the causes that should always be excluded first when assessing a patient. This is followed by writing down the causes that are the most commonly missed, misdiagnosed, or diagnosed late, which are often the less “obvious” causes. These represent the alternative, “must-always-consider” causes. Given that the majority of diagnostic errors are associated with 3 disease processes, namely cancer, vascular events and infections, it is important to think of the specific causes from these disease processes that relate to each symptom. For example, in a patient presenting with back pain, metastatic spinal disease, myeloma, dissecting aortic aneurysms and infections of the spine and pyelonephritis are often not considered as being the cause and are, therefore, missed.

Once a list of the diseases associated with each symptom has been created, it is necessary to learn about the diagnostic criteria for each disease. This is required for two reasons. Firstly, one cannot formulate a diagnosis without knowing what the diagnostic criteria are for that diagnosis. Secondly, diagnostic reasoning involves comparing information gathered from the clinical assessment to the diagnostic criteria for the possible causes. In other words, in order to be able to “exclude the worst, first”, one needs to know what to exclude and how to exclude it. The typical pattern of illness for each disease needs to be learned, along with the “red flag” findings that indicate the presence of that disease. It is also necessary to learn about the risk factors for developing these diseases, so that these can be proactively checked for and their significance recognised. For example, in a patient presenting with flu-like symptoms, it is essential to check for the risk factors for the patient’s symptoms being due to an unusual infection, which makes evaluating their potential vulnerability and exposure to unusual organisms necessary. Risk factors are of particular relevance in the assessment of patients with minor illness, as it is important to identify those patients who are increased risk of developing a serious complication of a minor illness, as these patients will need to be managed differently and may require targeted treatment.

Media campaigns and the availability of medical information on the internet have led to an increase symptom awareness amongst patients and relatives, such that most patients who have the typical symptoms of a serious illness will either call an ambulance, or go straight to the Emergency Department. This increases the likelihood that a patient with a serious illness presenting in primary care will have an early, or atypical presentation of a serious illness, as the significance of the symptoms will not have been recognised by the patient, or parent. However, studies have shown that it is most frequently the early and atypical presentations of the 3 main disease processes that are commonly misdiagnosed by health care professionals, so it is vital that all health care professionals are aware of the early and atypical presentations of each serious illness, as well as the typical presentation (Newman-Toker et al, 2019). Patients with serious illnesses, such as sepsis and invasive meningococcal disease may present to the practice nurse before the typical symptoms and signs of these illnesses have developed, which makes knowing about the early presentations of these life-threatening medical conditions essential, if they are to be diagnosed correctly. Similarly, it is the atypical presentations of cancer, heart attacks, strokes and pulmonary emboli that are most frequently missed, either because they have arisen in an atypical patient, or in an atypical way.

Clinical assessment is the tool that is used for information-gathering but it should also be appreciated that it is the component in the diagnostic process that links the clinician’s medical knowledge to their diagnostic reasoning process. Learning how to perform a clinical assessment correctly is usually a two-stage process. The first stage involves learning the generic process of gathering information, whilst the second stage involves learning how to perform a focused clinical assessment in which the clinician’s medical knowledge and diagnostic reasoning skills are applied to the generic clinical assessment to ensure that the information required to formulate the correct diagnosis is gathered. In primary care, it is necessary to learn how to perform clinical assessments that are symptom-based and patient safety-focused. This takes account of the fact that one performs a different clinical assessment in a man presenting with chest pain to a lady of fertile years presenting with right iliac fossa pain. In order to avoid diagnostic errors due to not gathering the correct information, it is important to come to the consultation with a set of pre-prepared, clinical assessment “toolboxes”, with each toolbox being related to a specific symptom that the patient may present with.

Each clinical assessment toolbox should contain the medical knowledge and diagnostic reasoning algorithm required to formulate each of the potential diagnoses associated with that symptom. The National Institute for Health and Care Excellence (NICE) guidelines for each symptom and associated disease represent an excellent learning resource for the medical knowledge required, including the diagnostic criteria for specific diseases and the red flags warning indicators and risk factors for developing the serious illnesses and serious complications of minor illnesses. Risk assessment tools and early warning scoring systems for serious illness can be embedded into the relevant clinical assessment, bringing a patient safety focus to the assessment that is performed. Specific medical knowledge triggers can also be incorporated into the clinical assessment to prevent errors due to not recalling vital pieces of medical knowledge, such as a mnemonic of the “must-not-miss” and “must-always-consider” causes of that symptom.

Diagnostic reasoning involves what is known as Dual Process Thinking, which is a combination of Type I 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). In short, Type 1 thinking often involves the use of reasoning shortcuts and pattern-recognition in formulating a diagnosis, which may result in a diagnosis being formed before all the information from the clinical assessment has been gathered. “Jumping to a conclusion” too early in the diagnostic process creates the risk that any information gathered subsequently during the clinical assessment that challenges the diagnosis made will either be ignored, or not given the weighting that it deserves. This is why it is necessary to apply Type 2 thinking within the diagnostic process to ensure that all the information gathered during the clinical assessment is processed and analysed correctly. This can be achieved by considering that the first diagnosis that is formulated is not the final diagnosis but, rather, a preliminary diagnosis, or a “diagnostic hypothesis”, which needs to be tested and challenged before it is accepted. This is why it is important to check that all the information gathered during the clinical assessments fits with the preliminary diagnosis that has been made. If there are any findings that do not fit with this diagnosis, the diagnosis should be reviewed and another diagnosis should be considered, as all the findings may then fit neatly into that diagnostic “box”. This is particularly important when assessing patients with the symptoms of a minor illness, as knowing which symptoms and signs do and do not fit with a diagnosis of minor illness can help in differentiating between serious and minor illnesses. Sometimes, the first evidence that a patient has a serious illness is the presence of a symptom or sign that is not compatible with a minor illness.

Diagnostic reasoning is a highly-complex mental process, which can be influenced by factors that impact on 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. The mnemonic provides an opportunity for practice nurses to reflect on the way that they go about making diagnoses and to think critically about the diagnostic reasoning system dysfunctions and transient malfunctions that exist both within themselves and within their workplace. This is important because many diagnostic reasoning system dysfunctions can be only be avoided by identifying and correcting them prior to the consultation. In addition, increased awareness of the external and internal factors that lead to transient diagnostic reasoning system malfunctions can be used to incorporate error prevention strategies and error detection interventions into consultations. Examples of this include creating protected time in the day for reflection and critical thinking about diagnoses; avoiding interruptions and distractions during consultations; use of the two-stage diagnostic process; and developing strategies to manage stress, time pressures and challenging consultations, safely.

“Problem” consultations are those in where there is known to be a higher risk of diagnostic error. This includes consultations that involve friends, family and colleagues and with patients who evoke negative feelings in us during the consultation, as our ability to gather the necessary information and perform diagnostic reasoning objectively can be adversely influenced by the way that one feels about the patient. Consultations where the assessment the patient is shared between different clinicians may lead to diagnostic errors as a result of misunderstandings, or miscommunication between individuals. External factors in the workplace can also impact on the diagnostic reasoning process, such as having insufficient time or equipment to gather information on the patient and to process that information correctly. “Problem” consultations also include complex clinical situations where the risk of diagnostic error is increased, such as patients with multimorbidity and polypharmacy, as well as cases where the risk of diagnostic error comes from the clinician being asked to practice outside their area of clinical competence.

A re-assessment of the patient’s diagnosis is required whenever a patient presents with ongoing symptoms. This is partly because illness is a dynamic process. It should always be borne in mind that the original diagnosis was based upon the findings that were present at the point in time in the illness that the patient was assessed and the findings were interpreted within the context of the duration of the illness at that point in time. A re-assessment of the diagnosis should be made because the existing symptoms may have worsened; or new symptoms and signs may have developed since the first assessment; or the duration of symptoms may indicate that an alternative diagnosis now needs to be considered. Similarly, the diagnosis should always be re-assessed in cases of treatment failure because the treatment

was prescribed for the original diagnosis, which may no longer be the correct one. Over-reliance on a previous diagnosis may compound a diagnostic error, regardless of whether the diagnosis was made by you or by someone else, so it is essential to re-assess the patient and their diagnosis each time that they are seen.

There is a saying that applies to information-processing in general, which is “rubbish in, rubbish out”. This is also the case in the diagnostic reasoning process, which highlights

the importance of critically evaluating both the quantity and the quality of information gathered during the clinical assessment. Patients and relatives may omit, over-emphasise, or under-emphasise parts of the history, due to their lack of medical knowledge. Patient records, referral letters and verbal hand-over of patients tend to contain only that information which supports a diagnosis, not the information that challenges the diagnosis.

A patient may have been seen by multiple clinicians in different locations for the same problem and this clinical information, along with the results of tests and investigations may be very relevant to the diagnosis, so it is important that this information is accessed whenever possible. However, it is not just a matter of gathering as much information as possible but also interpreting that information correctly, in terms of knowing about the diagnostic reliability and validity of specific clinical findings and of tests and investigations. Inappropriate over-reliance on, or misinterpretation of, clinical findings or results, can lead to errors in diagnosis.

Cognitive biases and heuristics (mental shortcuts) are forms of dysfunctional diagnostic reasoning and these dysfunctions may arise either as a result of not having been taught how to perform diagnostic correctly, or they can form over time. It is important to develop a sound system of diagnostic reasoning and to regularly check the system for the presence of dysfunctional reasoning behaviours should be performed (Royce et al, 2019). Diagnostic reasoning is performed differently in primary care and primary care is also home to a number of specific diagnostic reasoning dysfunctions (Abimanyi-Ochom et al, 2019). An example of a cognitive bias that occurs in primary care is “Horse and Zebra Syndrome”, based upon the fact that zebras are rare and horses are common. In other words, common things happen commonly and uncommon things happen uncommonly. In the minor illness clinic, a serious cause for a patient’s symptom is uncommon, so the risk is that one can become lulled into a false sense of security in which one either stops checking for a serious cause, or ignores information that should point to a serious cause. This dysfunction can mean that the diagnosis of a serious illness is not considered, or missed.

Whereas cognitive biases and heuristics are examples of a dysfunctional reasoning system, transient reasoning errors are factors that impact on the way that we think and reason. These factors can be external or internal. External distractions and interruptions to the consultation, along with internal tiredness, stress, illness, or mood disorders, can all lead to diagnostic errors from transient cognitive impairment, whilst 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.

Diagnostic isolation is a common problem in primary care, as clinicians are, in effect, functioning as lone workers within their consulting rooms. It is important to develop good diagnostic safety and diagnostic support systems within the practice to reduce the risk of diagnostic errors. The first step in this process is for the practice nurse to establish a clearly-defined scope of practice, based upon their medical knowledge, clinical assessment skills and diagnostic reasoning abilities, along with their clinical experience. The diagnostic safety system is designed to ensure that only those patients who fall within the nurse’s defined scope of practice are referred to them. This involves making patients, receptionists and other members of the practice team aware of the competencies and limitations that are defined within the nurse’s scope of practice and recognising that practicing outside the scope of practice can have serious consequences for the both the patient and the nurse. It is also important for the practice to have a good diagnostic support system in place, so that the practice nurse can discuss or refer patients in real-time and also provide protected time for the nurse to reflect on uncertain, or challenging diagnoses and to discuss these cases with other members of the practice team. Performing a diagnostic audit is important to help detect areas in the nurse’s medical knowledge, clinical assessment skills and diagnostic reasoning abilities, so that this information can be linked to the practice nurse’s continuing professional development plan. This will not only help in the development of the practice nurse’s diagnostic skills but also reduce the risk of diagnostic error in future.

Clinical assessment is not a perfect tool and at the end of the consultation it may not be possible to make an 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. Where the diagnosis is equivocal, diagnostic uncertainty exists and this needs to be managed in as safe a way as possible. Recognising the potential for diagnostic uncertainty and managing it safely is an essential part of safe practice (Silverston et al, 2014). Diagnostic uncertainty is common in primary care and may be a function of a number of different factors. There are a number of different options available to the practice nurse when diagnostic uncertainty exists, which include seeking diagnostic input from another member of the practice team; reviewing the patient again to see if their symptoms have changed; referring the patient to hospital for further diagnostic tests and investigations; or sending the patient home with safety-netting advice (Silverston, 2014). What is important is that the criteria for making each of these clinical decisions is considered in advance and a diagnostic support system is in place to facilitate this process.

 One of the most important methods of reducing the risk of serious harm from diagnostic errors is to provide safety-netting advice to patients and their relatives (Silverston, 2014). However, it is important that the medical content of the safety-netting advice that is delivered relates to the potential serious illnesses and alternative diagnoses that are related to the symptom that the patient is presenting with. This should include advice on the red flags, typical and atypical presentations of those illnesses, as well as the earliest findings that would fit with the diagnosis of a serious illness or complication, or would not fit with a minor illness (Silverston, 2020).

**In-Consultation**

Using the same mnemonic in pre-consultation preparation, as well as during the consultation helps connect what is learned in the classroom to clinical practice and helps in the development of a systematic approach to the prevention and detection of diagnostic errors.

The mnemonic can be used as a generic diagnostic checklist template, either as a hard copy, or as an electronic reminder on the computer screen but it can also be incorporated into symptom-specific diagnostic templates and embedded into diagnostic algorithms. The first part of the mnemonic should be used during the clinical assessment to facilitate focused information-gathering and during diagnostic reasoning to encourage critical thinking when moving from the preliminary to the final diagnosis. The second part of the mnemonic acts as a diagnostic error checklist and serves as a reminder of the need to check for the presence of risk factors that can lead to errors in diagnosis.

**Post-Consultation**

The mnemonic can form part of the process of reflection and critical thinking that should take place when reviewing uncertain or challenging diagnoses and to bring a systematic approach to this process. It can also be used when cases are being discussed with colleagues to help focus the discussion on the information and factors that need to be considered. Where a diagnostic error has occurred, or when a diagnostic audit has been performed, the mnemonic can be used to identify the cause of the diagnostic error, so that measures can be adopted to prevent the error happening again.

**In Conclusion**

There are about 250 main symptoms that patients may present with and there are, approximately, 12,500 recognised diseases. On average, therefore, there are 50 potential causes for every symptom. This means that a significant amount of medical knowledge needs to be available during the consultation if a diagnostic error due to a knowledge deficit is to be avoided. Add to this the fact that clinical assessment is not a perfect tool and that diagnostic reasoning is subject to a vast array of system and human factors and it becomes almost inevitable that some diagnostic errors will occur. However, up to 80% of diagnostic errors are deemed to be preventable through better education on how to formulate a diagnosis correctly and on the causes of diagnostic error and through the development and implementation of better systems to prevent and detect diagnostic errors in clinical practice. The same patient safety-focused attitudes and behaviours that have been used successfully to reduce the risk of treatment errors now needs to be applied to reducing the risk of diagnostic errors. SAFER PRACTICES represents a pragmatic and systematic approach to the problem of diagnostic error in primary care, in which a symptom-based, patient safety-focused, mnemonic is used pre-consultation, in-consultation and post-consultation, to prevent and detect diagnostic errors. As such, it can be used by practice nurses to both enhance and improve their diagnostic skills and to reduce the risk of diagnostic errors.

**Box A. 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, or complication?

**P = Problem**. Have I considered whether this was a *problem* consultation?

**R = Re-assessed.** Have I *re-assessed* the diagnosis, myself?

**A = Assessment errors.** Have I evaluated the quantity and quality of information gathered from my clinical *assessment*?

**C = Cognitive errors**. Have I checked for *cognitive* errors and other reasoning system dysfunctions?

**T = Transient reasoning errors.** Have I checked for a *transient* reasoning malfunction?

**I = Diagnostic isolation.** Should I have checked this diagnosis with *someone else*?

**C = Checklist check.** Have I checked my personal risk *checklist*?

**E = Equivocal**. Is this an *equivocal/uncertain diagnosis*?

**S =** **Safety-netting.** Have I *safety-netted* the patient or relative?

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**Key points**

Diagnostic error is relatively common in primary care and results in serious harm to patients. Diagnostic errors are preventable in up to 80% of cases.

The World Health Organisation has declared that reducing diagnostic in primary care should be considered a global priority.

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 the same checklist is used pre-consultation, in-consultation and post-consultation.

This article describes a mnemonic checklist that can be used in both teaching and clinical practice to prevent and detect diagnostic errors.

**Reflective questions**

Q1. What are the basic principles involved in formulating a diagnosis?

Q2. What are the common causes of diagnostic error?

Q3. Why is it important to come to the consultation with the correct medical knowledge, clinical assessment toolboxes and diagnostic reasoning skills?

Q4. Why is it important to adopt a symptom-based, patient safety-focused approach to the diagnostic process in primary care?

Q5. How can you use the SAFER PRACTICES in your own practice to enhance and improve your diagnostic skills and to check for diagnostic errors?