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4 **Structured Abstract**  
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7 The delivery of healthcare in most developed countries is under increasing pressure. Ageing  
8 populations with increasingly complex needs, coupled with financial constraints and  
9 imbalances in workforce, mean that healthcare policies look to contain cost and utilise  
10 resource as effectively as possible. Self-care is now widely advocated as a mechanism to  
11 manage acute presentations with pharmacy identified as a key resource to support such  
12 policy. Pharmacy teams are ideally positioned to facilitate the management of patients who  
13 present with acute illness. However, current evidence suggests that patient assessment and  
14 establishing a differential diagnosis could be better. It appears that how pharmacists are  
15 taught at Schools of Pharmacy adopts a protocol driven approach, which assumes  
16 presentation of low acuity conditions, and we argue that this method must be replaced with a  
17 curriculum that adopts clinical reasoning. This paper sets out the process of clinical reasoning  
18 and how the profession could embrace this as a better model in establishing a diagnosis.  
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27 **Keywords**  
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29 Clinical reasoning; Differential diagnosis; Community pharmacy; Self-care; Minor illness  
30 management; Community pharmacy practice  
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3 **Differential Diagnosis in Pharmacy Practice: Time to Adopt Clinical Reasoning and**  
4 **Decision Making**  
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## Differential Diagnosis in Pharmacy Practice: Time to Adopt Clinical Reasoning and Decision Making

### Introduction

The liberalisation of medicine availability away from prescription control has given consumers access to more medicines than ever before.<sup>1-2</sup> Reclassification has seen a wide range of new therapeutic agents made available to consumers, including proton pump inhibitors, triptans and 'lifestyle' medicines to help with obesity and erectile dysfunction. This has contributed to community pharmacies managing increased numbers of people who seek help and advice for a wide range of minor illness, and has undoubtedly effected consumer purchasing patterns.<sup>3-4</sup> Facilitation of patient self-care by pharmacy teams also has the potential to relieve and reshape primary care physician workload and contribute to the Royal College of General Practitioners goal of the 15 minute consultation.<sup>5-7</sup> This is exemplified in the UK through the government's continued promotion of self-care via formally recognised and remunerated roles such as the Scottish national minor illness scheme<sup>8</sup> and the Community Pharmacy Consultation Scheme embedded in the new contractual framework in England.<sup>9</sup>

Pharmacists and the wider pharmacy team, more than ever before, must be able to competently manage these patients to provide advice, treatment or onward signposting to others to ensure appropriate care. However, to date, research evidence clearly shows that community pharmacy staff find it difficult to consistently interpret signs and symptoms to arrive at a diagnosis through appropriate questioning and counselling.<sup>5, 10, 11</sup> Brata et al found the frequency of information-gathering was inconsistent and varied widely, with reported rates as low as 18% in observational studies but as high as 97% during encounters with simulated patients. Van Eikenhorst also found counselling was inconsistently offered and when it was, it was not always of sufficient quality. In a further review by Sinopoulou, pharmacy staff performance was described as poor regardless of geography or scenario used, and was linked to the reliance on mnemonic/protocol driven approaches in establishing the cause of patients' signs and symptoms. This is not surprising given mnemonics are about information acquisition and do not extend to assisting the pharmacist with considering the relevance of the information gathered in the context of possible causes of symptoms or underlying pathologies. In addition, the nature of asking set questions in a set order also means that questions may be asked that have no direct relevance to the examined conditions and hence the gathered information is not useful in establishing the cause of the problem.

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Whilst the adoption of such strategies can mean standardisation of questions asked, they seem to fall short in providing consistently high performance levels in achieving desired outcomes yet these approaches are widely taught at Schools of Pharmacy. A 2019 report on global education practice on the teaching of non-prescription medicines at undergraduate level highlighted instructional methods in establishing a diagnosis predominantly involved the use of a mnemonic.<sup>12</sup> This may, in part, be because they are potentially easy to remember (although the longer mnemonics, e.g. SCHOLAR-QUEST are more challenging) and quick to implement or that educators are replicating the way in which they were taught themselves. This approach may have merit with non-pharmacist staff, who have less knowledge than a pharmacist, and indeed constraints on pharmacist time and workload often mean consultations are first conducted by counter staff.<sup>13</sup> A framework for these staff may be appropriate providing the pharmacist is then consulted before management plans are put in place; unfortunately this is often not the case, with these staff frequently going on to make diagnostic decisions and treatment planning for the patient.

### **Time for a new approach**

The use of protocols and mnemonics have allowed the profession to embrace a greater role in facilitating patient self-care at a time when patient-facing responsibilities were being developed. Now, in 2020, where pharmacists are expected to take greater responsibility and accountability for patient care their use has to be questioned given contemporary literature is critical of staff performance. Pharmacists are no longer being asked to just respond to symptoms with the assumption that presenting complaints are of low acuity - they are being asked to help patients manage a broader range of conditions. Whilst it is acknowledged that many of these conditions are often self-limiting, pharmacists are increasingly finding that they are in a position where they are effectively triaging patients.

### **Adoption of Clinical Reasoning**

Clinical reasoning is the cornerstone on which a diagnosis is made and relies on the practitioner being both knowledgeable and a good decision-maker. Currently, no reports exist of pharmacy schools explicitly requiring clinical reasoning to be embedded within the curricula, and only one study by Fuentes has described an elective course that introduced this concept to facilitate a differential diagnosis.<sup>14</sup> Emphasis is still on knowledge acquisition much more than decision-making, although more curricula time is being dedicated to physical assessment skills at both under and postgraduate level that does require comprehension of critical thinking. However, the way in which pharmacists think, reason and ultimately make decisions is a fundamental skill to adopt and master.

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121 Clinical reasoning is an evidence-based, dynamic process in which the health professional  
122 combines scientific knowledge, clinical experience and critical thinking, with existing and newly  
123 gathered information about the patient against a backdrop of clinical uncertainty.  
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127 The role of the pharmacist in acute and emergency care is analogous to that of the general  
128 practitioner, acting as an expert generalist,<sup>15</sup> thus the pharmacy profession can learn much  
129 from how our medical colleagues are taught about the 'art' of diagnosis.  
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133 This article draws on works from the medical and nursing literature to highlight how the  
134 profession can adopt clinical reasoning and decision making to embed in to daily practice.  
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137 We have arbitrarily divided this skill in to a number of key steps to encourage its adoption,  
138 which is depicted in Figure 1, and described below.  
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### 142 **Information Gathering**

143 The starting point in any consultation will be when the patient first presents. This may be for a  
144 new or existing complaint, but in the context of community pharmacy consultations this will  
145 generally be for acute first time presentations often with a person unknown. This provides an  
146 opportunity to listen to the patient (as Osler's maxim states, '*Listen to your patient, they are*  
147 *telling you the diagnosis*') and acquire 'data', via observation and exploratory information  
148 gathering of the patients presenting complaint. At this point, and often at the subconscious  
149 level, the practitioner will define the problem, known as problem representation.  
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### 153 **Problem Representation**

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155 A short summary of the presenting complaint is defined and reasoning can be categorised in  
156 terms of thinking about the symptoms as paired opposing descriptions that can then be used  
157 to compare and contrast, known as semantic qualifiers. The ability of practitioners to effectively  
158 employ this strategy is dependent on clinical experience. In the medical literature this is often  
159 related in terms of moving from novice to expert practitioner. Those with greater clinical  
160 experience and exposure draw on their own insights into, and knowledge of, any given disease  
161 – these are termed illness scripts. This ability to draw on memory from previous presentations  
162 provides the clinician with opportunities to relate this knowledge to become more accessible  
163 for reasoning. In effect, multiple previous cases are used as an overlay to help decision-  
164 making to the case in front of the clinician, which incorporates an understanding of contributory  
165 risk factors, pathophysiology and clinical characteristics.  
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180 **Diagnosis**  
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182 At this point a tentative differential diagnosis can be hypothesised and tested based on the  
183 most likely diagnosis postulated from the problem representation and drawing from illness  
184 scripts. A variety of reasoning strategies can be used and are either inductive or deductive in  
185 nature. Those with limited experience ('novice') tend to adopt a deductive approach whilst  
186 those classed as experts utilise inductive techniques. The characteristics of both approaches  
187 is summarised in Table 1.  
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192 **Continued Information Gathering**

193 Using the potential diagnoses as a guide, and the illness scripts of the related disease states,  
194 the clinician asks directed questions. This means asking the right question at the right time for  
195 the right reason, including enquiry, where relevant, about history of the presenting complaint,  
196 past medical history and medication history as well as family and social histories. We advocate  
197 that all undergraduate teaching adopt a hypothetico-deductive model given that student  
198 knowledge on condition presentations will be new and their clinical experience very low. A  
199 worked example of hypothetico-deductive reasoning is provided at the end of the article.  
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205 **Problem Refinement**  
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207 As the clinician explores additional information, directed by the initial consideration of  
208 diagnoses, the ordering of likelihood of diagnoses can take place. For example, the likely  
209 diagnosis of a headache will be tension-type but if answers gained to questions asked do not  
210 'fit' then an alternative diagnosis needs to be considered. It is likely that the clinician will work  
211 iteratively (around the right hand circle of Figure 1) several times refining problems, until a  
212 differential diagnosis is established. This is especially true if the clinician adopts a deductive  
213 clinical reasoning model. Where inductive reasoning is employed, then 'short cuts' are often  
214 observed and is referred to as the use of heuristics or pattern recognition. This is seen  
215 extensively with expert practitioners.  
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221 **Examination and Investigation**  
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223 Once diagnoses have been considered and ordered, targeted examination and investigations  
224 can be used to help support or reduce the likelihood of a single diagnosis. The usefulness of  
225 examination and tests tends to increase the diagnostic probability of a correct diagnosis.  
226 Having said this, it has been reported that correct use of clinical reasoning strategies through  
227 questioning alone results in a high proportion of correct diagnosis. This is especially important  
228 in community pharmacy practice as routine physical examination and testing are rarely  
229 undertaken.  
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239 **Review of symptoms/red flags**  
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241 There will always be a degree of clinical uncertainty when making a differential diagnosis, and  
242 as such clinical reasoning is not fool proof and prone to diagnostic error in a small proportion  
243 of cases. The types of error associated with clinical reasoning are well documented but outside  
244 the scope of this article. Needless to say strategies need to be adopted to minimise error. At  
245 this stage, even though the clinician may be relatively confident of the diagnosis, ‘ruling out’  
246 causes with sinister pathology (e.g. exploration of symptoms which may be indicative of critical  
247 diagnoses) are an essential component of the process and should take place even if these  
248 have not been triggered by the presentation.  
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254 Whilst the vast majority of community pharmacy presentations will be self-limiting and non-  
255 serious, the sheer volume of people attending at a pharmacy means that on rare occasions a  
256 critical diagnosis will be encountered. It is therefore necessary to check and review symptoms  
257 prior to instigating management strategies in case symptoms have been overlooked. Of  
258 course, if too much uncertainty exists in establishing the cause of the patients signs and  
259 symptoms then an onward referral should be made.  
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264 **Management and Safety-netting**  
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266 Options for management range from advice/sign posting through to urgent and immediate  
267 referral. Management plans should be made with the patient and take account of their ideas,  
268 concerns and expectations. Treatment, if instigated, should be as evidence-based as  
269 practicable, notwithstanding the difficulties of establishing efficacy of many OTC products.  
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273 As the diagnosis made is based on probability, the clinician needs to ensure that the patient  
274 knows what to do if the management plan does not produce the desired outcome, including  
275 deterioration or failure of symptoms to improve. Each patient will require individualised  
276 counselling depending on the diagnosis made and the potential consequences of mis-  
277 diagnosis although information provided tends to centre on specific symptoms that are of  
278 concern, time-frames for resolution of symptoms or actions needed if the problem requires  
279 escalation.  
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298 **Conclusion**  
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300 Clinical reasoning is central to wise action when assessing patient's signs and symptoms to  
301 arrive at a differential diagnosis. It is a critical skill, but is infrequently taught or promoted within  
302 the pharmacy profession. We believe a paradigm shift is required to embed a clinical  
303 reasoning syllabus within undergraduate pharmacy programmes and for postgraduate  
304 provision to broaden their clinical skills provision to include information gathering, sorting,  
305 reasoning and decision making, coupled with metacognition to develop and embed expertise  
306 rather than concentrate on examination skills. Without such change then the profession risk  
307 not being able to realise its potential in maximising the contribution front line pharmacists make  
308 to facilitating patient care. Of course this will take time and require pharmacy schools to  
309 consider how best to equip students and pharmacists in developing diagnostic expertise.  
310 Strategies could utilise deliberate practice and feedback as described by Weiss<sup>16</sup> rather than  
311 adopting traditional medical models for which pharmacy schools and educators are currently  
312 poorly equipped.  
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**Table 1: Characteristics of Deductive and Inductive reasoning\***

Induction	Deductive
Fast, effortless	Slow, time consuming
Automatic, sub-conscious	Deliberate, conscious
Intuitive	Systematic
Vulnerable to error	Less prone to error

\*Deductive reasoning is also referred to as analytical or Type II thinking. Inductive reasoning is also referred to as non-analytical or Type I thinking

**Worked example of Hypothetico-deductive reasoning**

<b>Information Gathering</b>	<p><b>Observation:</b> 40-year-old female patient smartly dressed and appears in no obvious discomfort.</p> <p><b>Patient presentation:</b> I need some painkillers for this headache I have. It started yesterday and hurts near the front and side of my head and just won't go away unlike other headaches I've had which have settled down on their own.</p>
<b>Problem Representation</b>	Acute onset, non-episodic, unilateral and painful headache, female, 40 years old
<b>Differential Diagnosis</b>	<p>Tension-type headache and migraine are the most likely primary causes of headache to consider. Other secondary causes (e.g. infection) or more unusual primary causes (e.g. cluster headache) cannot be ruled out at this point.</p> <p>Based on the problem representation and utilizing a hypothetico-deductive reasoning model we need to test hypotheses of tension-type headache or migraine being the cause through further information gathering.</p>
<b>Continued Information Gathering</b>	<p><b>Nature of pain:</b> In tension-type headache pain would be expected to be aching/dull compared with migraine which would be throbbing</p> <p><b>Severity of pain:</b> In tension-type headache we are expecting a response that does not suggest interference with daily activities</p>
<b>Problem Refinement</b>	<p>If the patient responded that pain was throbbing in nature and painful (we already know it appears to be atypical compared to other headache episodes) then these more closely align to a diagnosis of migraine.</p> <p>Therefore the ordering of likelihood of the diagnosis would be migraine followed by tension-type headache.</p> <p>Further refinement by asking more questions that help to confirm a diagnosis of migraine would be appropriate, for example</p> <p><b>Associated nausea?</b> Tension-type headache is not typically associated with nausea where as it is extremely common in migraine.</p>

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	<p>A positive history of nausea strongly supports a diagnosis of migraine, however, atypical presentation of tension-type headache cannot be fully disregarded.</p> <p><b>Family history?</b> Migraine is associated with a family history; so again if this seen it further confirms thinking that the patients symptoms are migraine-related</p> <p>This process could continue asking further questions that help to discriminate between the two conditions. For example triggers (seen in migraine) and social histories (e.g. stressful situations)</p>
<b>Examination and Investigation</b>	In this scenario examinations and tests will not help further the differential diagnosis
<b>Review of symptoms / red flags</b>	Symptoms are very suggestive of migraine. Confirmation that the person has no other neurological symptoms, change in consciousness, or systemic symptoms would be appropriate to eliminate any critical diagnoses..
<b>Management and Safety-netting</b>	<p>Management: pain relief or instigation of a triptan (providing no contra-indications present and pharmacist confident of the diagnosis) and a conditional referral to the GP if symptoms last for a further 48 hours or more (migraines can last for 72 hours and the patient has symptoms for approximately 1 day already). It should be noted that in formulating this management plan, the pharmacist <b>is accepting responsibility for formulating a working diagnosis</b>, based on their individual understanding of the presenting complaint, illness scripts, problem refinement and decision-making process. This is therefore based on the individual competency of the practitioner but pharmacists need to accept responsibility, and therefore clinical accountability on the decisions they reach in providing patient care.</p> <p>Safety-netting: appearance of systemic symptoms, e.g. fever, or wider neurological symptoms, should be accounted for in the advice provided to the patient, along with timeframes and referral pathways. For example, should the patient develop a rash and photophobia, urgent referral to the emergency department would be warranted. This links in with critical diagnoses that are considered as part of differential diagnosis.</p>

Figure 1: The clinical reasoning cycle

The cycle commences at the purple information gathering box.

The right-hand circle of this processes is largely concerned with managing an **undifferentiated patient** or one with a weak or incomplete working hypothesis, where differential diagnoses need to be considered in depth to arrive at a more developed working hypothesis. At that point the clinician would progress to the left-hand circle.

The left-hand circle is largely concerned with therapeutic management, or where a clinician is working under the diagnosis of another, for example in chronic disease management or where 'supplementary' management is taking place. Such an approach would require the clinician to consider the working hypothesis, in terms of its relevance to any symptom presentation or treatment failure, and if these appear incompatible with the working hypothesis, then the clinician would move to the right-hand circle.



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