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# The Influence of Time Pressure and Case Complexity on Physicians' Diagnostic Performance

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## Abstract

*Purpose:* Practicing medicine is a cognitively demanding task that consists of the ability to assess the patient, judge the nature of his or her complaints, and make an appropriate diagnosis. A number of factors have the potential to affect the physician's diagnostic performance negatively. Two of these factors are time pressure and case complexity. However, the empirical evidence that supports this negative influence is scant. This study experimentally investigated the effect of time pressure and the complexity of clinical cases on diagnostic accuracy.

*Method:* Thirty-seven senior internal medicine residents participated in this study. These residents were randomly allocated to two experimental groups (with time pressure vs. without time pressure). These residents were instructed to diagnose 8 case scenarios (4 straightforward and 4 complex cases) presented on a computer by using E-Prime® 2.0. The time pressure group received feedback after each case that they were behind schedule, whereas the control group did not receive such information. The dependent variables were the mean diagnostic accuracy and the mean processing time spent on each case during diagnosis.

*Results:* Participants under time pressure spent nearly the same time as the group without time pressure in diagnosing the clinical cases. The diagnostic accuracy scores did not differ significantly between the experimental and control group ($F(1,35)=0.07$, $P=0.79$, and $\eta^2=0.002$). Conversely, a main effect of case complexity was found ($F(1,35)=203.19$, $P<0.001$, and $\eta^2=0.85$). Participants processed straightforward cases faster and more accurately compared with complex cases. No interaction was found between time pressure and case complexity on diagnostic accuracy ($F(1,35)=0.003$, $P=0.96$, and $\eta^2<0.001$).

*Conclusions:* Time pressure did not impact the diagnostic performance, whereas the complexity of the clinical case negatively influenced the diagnostic accuracy. Further studies with the enhanced experimental manipulation of time pressure are needed to reveal the effect of time pressure, if any, on a physician's diagnostic performance.



*Keywords:* Time pressure; Case complexity; Clinical reasoning; Physicians; Diagnostic error

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## 1. Introduction

Physicians can make mistakes. According to a report by the Institute of Medicine (IOM), 44,000–98,000 people die each year in the United States alone as a result of medical errors.[1] These errors include medication mistakes, surgical errors, the neglect of serious conditions, and diagnostic errors which form a large part of such mistakes. It is estimated that the death rate caused by the incorrect diagnosis is higher than for any other type of medical error.[2,3] A Canadian study[4] reported the incidence of adverse events among hospitals and reported that 10.5% of adverse events was related to diagnostic errors. In 2008, Berner and Graber[5] published an extensive review of studies that focus on diagnostic error. The researchers recognized that the diagnostic error rate in clinical specialties is higher (a maximum of 10–15%) compared with perceptual specialties such as radiology, dermatology, and pathology (less than 5%). Understanding the etiology of diagnostic error in clinical practice is important because the causes of diagnostic errors involve both environmental influences and cognitive factors.[6]

Practicing medicine is a cognitively demanding task that requires the ability to assess a patient, to judge the significance of signs and symptoms, and to arrive at the appropriate diagnosis. In certain clinical situations, these tasks are not easily performed, particularly when under time pressure. Physicians usually see, per visit, a high volume of cases of varying difficulty level that need diagnosis and treatment planning. Having to deal with many cases, in a limited amount of time, exerts time pressure on the physicians, which may eventually affect the quality of care provided.[7,8] Given that time pressure is a reality in medical practice, and has been linked to stress, fatigue, low job satisfaction, and suboptimal patient care,[9,10] it is important to investigate whether it also has a negative effect on the diagnostic performance of a physician.

Besides time pressure, the nature of the case has also an important influence on the diagnostic reasoning process. Studies have shown that the level of case difficulty influences diagnostic reasoning and accuracy.[11,12] It has been found that complex cases often result in medical error.[13] Combining both conditions, time pressure may hypothetically interact with case difficulty, exacerbating the probability of error. This assumption has, however, not been subjected to detailed investigation and requires further testing.

In addition to the above, it is important to realize that the diagnostic process involves a complex form of thinking, referred to as clinical reasoning, which involves multiple levels of cognition and metacognition.[14] According to Schmidt et al.[15] 'illness scripts' play an important role, which are mental representations of a disease and develop from continuous exposure to similar cases. Once an illness script is formed, it can be applied, rather effortlessly, to treating new patients. This heuristic process has been coined "non-analytical reasoning," whereas the diagnostic process involving systematic, effortful analysis of a case is referred to as "analytical reasoning" (or system 1 and system 2).[16]

It can be argued that when a physician is under time pressure, he or she has to rely more on non-analytical thinking because there is limited time for slow analytical reasoning. This is particularly a problem if the case is perceived as complex, that is, the physician does not have a well-developed illness script and needs to fall back on systematic analysis of the case.[17] But even if the physician has a developed illness script regarding the case at hand, heuristics are sometimes prone to result in cognitive biases and errors.[18,19]

To examine the extent of the potential issue of time pressure and case complexity on the accuracy of medical diagnoses, more studies are needed. The objective of the present study is to explore the effect of time pressure and case complexity, while diagnosing a clinical case, on physicians' diagnostic accuracy. We hypothesized that physicians under time pressure would spend less time in diagnosing the cases than physicians without time pressure, both for straightforward and for complex cases. Moreover, we hypothesized that the more non-analytical diagnostic mode would reduce the diagnostic accuracy scores obtained by physicians under time pressure in complex cases (but not in straightforward cases) in comparison with physicians who do not experience time pressure.

## 2. Method

### 2.1. Design

The experiment employed a $2 \times 2$ experimental study, with 'time pressure' ('under time pressure' vs. 'without time pressure') as a between-subjects factor, and 'case complexity' (straightforward cases vs. complex cases) as within subject factor. The dependent variables were the mean diagnostic accuracy scores and the mean response time for each case. The ethical approval to conduct the study was granted by the Institutional Review Board (IRB)

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