We shall argue in this paper that the method of diagnosis in practice is driven by our goal in diagnosis of determining a disease correctly in every given, individual patient with symptoms regardless of whether a disease is common or uncommon.

The method employed in practice to achieve this goal consists of hypothesis generation and verification (1).

In this method, a number of diseases, some common and some uncommon, are usually suspected from a presentation and formulated as diagnostic hypotheses to create a comprehensive differential diagnosis (2).

As a diagnostic hypothesis, a suspected disease is an assumption which may or may not be correct, which puts all suspected diseases as diagnostic hypotheses on an equal footing regardless of whether they are common or uncommon.

The formulation of a suspected disease as a diagnostic hypothesis is a crucially important step which enables uncommon diseases to be diagnosed rather easily as we see in clinicopathologic conferences (CPCs) and clinical problem solving exercises (3,4).

Each disease in differential diagnosis is evaluated by appropriate tests, usually starting with the most common disease in a non-urgent situation as it has the greatest chance of being present.

A disease is diagnosed definitively with a high degree of diagnostic accuracy when a highly informative test result with a likelihood ratio (LR) greater than 10 for it is observed (5).

Some examples of such test results are acute Q wave and ST elevation EKG changes (acute EKG changes), LR 13, for acute myocardial infarction (6) and positive chest CT angiogram for pulmonary embolism (7).

The hypothesis generation and verification method of diagnosis is highly accurate with a diagnostic accuracy of 98 percent in CPCs (3) and of 85-90 percent in general (8).
We find that the prescribed Bayesian method, in which the probability of a
disease is evidence for it in a given patient, is not employed for diagnosis in any
CPC or clinical problem solving exercise (3,4), because, as we shall now discuss,
it fails to fulfill our goal of diagnostic accuracy in every patient.

For example, an uncommon disease given a presentation may not be suspected in
the Bayesian method due to its low prior probability being interpreted as prior
evidence against it in a given patient leading to a diagnostic error.

The failure of the Bayesian method in diagnosing accurately in every patient is not
totally unexpected as this method has been prescribed not to ensure diagnostic
accuracy but on grounds of its unbounded rationality as a method of inference in
any field (9). In other words, the Bayesian method has been considered to be a ‘
one size fits all’ method of inference in all fields.

The notion of unbounded rationality of the Bayesian method for inference has
been challenged by the concepts of bounded rationality of Herbert Simon (10)
and of ecological rationality of Gigerenzer (11).

With these concepts, cognitive behavior including inference is governed primarily
by the goal in an environment in which cognition occurs and not by a notion of
unbounded rationality method such as in the Bayesian method.

Thus the method of hypothesis generation and verification for diagnosis is
ecologically rational as it fulfills our goal of diagnostic accuracy in any patient
regardless of whether a disease is common or uncommon.

The Bayesian method is not employed in practice, we suggest, because it is not
ecologically rational as it fails to fulfill our goal of diagnostic accuracy in every
patient.

The concept of ecological rationality has led to study of cognitive behavior in
other fields for example of how persons make economic decisions in actual
practice. It has been found that these decisions are based primarily on personal
preferences and not on rational choice theory which involves Bayesian reasoning (12).
This important finding has led to development of the field of behavioral economics in which more accurate models of economic decision making have been made (12).

In diagnosis, we seem to be stuck with the Bayesian method as the prescriptive model for diagnosis since mid 1960s despite empirical evidence (3,4) that this method is not employed for diagnosis in practice as it fails to fulfill our goal of diagnostic accuracy in every given patient.

We suggest it is time now to recognize that the prescription of the Bayesian method be replaced by the ecologically rational method of hypothesis generation and verification for diagnosis.

References


