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DEVELOPING A CLINICAL DECISION SUPPORT SYSTEM (CDSS) USING *PRAKRITI* (AYURVEDIC CONCEPT OF CONSTITUTION) AS A PRIME TOOL: A CONCEPTUAL FRAMEWORK

Janmejaya Samal*

District Epidemiologist, District Health Office, Gadchiroli, Maharashtra

***Corresponding Author:**

Janmejaya Samal, District Epidemiologist, District Health Office, Gadchiroli, Maharashtra

Mobile: 09901316384, 09438323843

Email: janmejaya_samal@yahoo.com

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ABSTRACT

Clinical decision support systems (CDSS) are important tools useful for arriving at a clinical decision. These systems help a physician or surgeon, depending on the type, in designing a proper therapeutic regimen. These systems are different from clinical information systems in many different ways. These are mainly information technology-based systems designed to improve clinical decision-making. Characteristics of individual patients are matched to a computerized knowledge base, and software algorithms generate patient-specific information in the form of assessments or recommendations. The same can also be done by using *Prakriti* as a prime tool. *Prakriti* and *Doshas* (humours) are closely interlinked as the latter determines the former of each and every individual. Again Ayurveda believes that harmony of *Doshas* lead to healthy state and the opposite lead to ill health so indentifying and analyzing the *Prakriti* of a particular individual by the help of a CDSS will definitely help to arrive at a clinical decision and help framing specific therapeutic regimen. In this particular study an attempt has been made to conceptually design a CDSS by using *Prakriti* as a prime tool. The conceptual framework designed in this study is based on the classical knowledge described in treatises of Ayurveda.

Keywords: Clinical Decision Support System (CDSS), Conceptual Framework, *Prakriti*.

INTRODUCTION

Clinical decision support systems provide clinicians, staff, patients, and other individuals with knowledge and specific, individualized information, intelligently filtered and presented at appropriate times, to enhance clinical performance and patient outcomes. It encompasses a variety of tools and interventions such as computerized alerts and reminders, clinical guidelines, order sets, patient data reports and dashboards, documentation templates, and diagnostic support¹. A physician usually diagnose a disease based on the clinical history and physical examination of the patient, visual inspection of medical images, as well as the results of laboratory tests. In a similar way Ayurveda has got a concept of *Prakriti* that has been in use by the physicians of Ayurveda for the assessment and diagnosis of individual patient. The concept of *Prakriti* can be used to develop a CDSS to help arrive at a clinical decision. The word *Prakriti* has been used in the sense of *Deha Prakriti* (Somatic Constitution) in Ayurveda. At the time of union of sperm & ovum, predominance of *Trigunas*, *Panchamahabhutas* (Five elements) & *Doshas* (Humour) decides the constitution of every individual. Involvement of *Dosha* in *Prakriti* formation

may be individual or intermingled. So, *Prakriti* is of seven types, i.e. *Vataj*, *Pittaj*, *Kaphaj*, three *Dwandwaj* (Combination of two humours) & one *Tridoshaj* (Combination of all the three humours). Characters which are manifested in a person of any specific *Prakriti* depend upon the properties of *Dosha* involved^{2,3,4}. Once this proportion is set, generally it remains permanent for the lifetime of that individual. Again an individual may have a natural predominance of one or more *Doshas*. These *Doshas* need not be present in equal proportion to ensure physiological balance, but they need to be functioning in harmony with one another. This state is called *Prakriti*⁵. *Prakriti* can be very much instrumental as a tool to develop a CDSS. *Prakriti* and *Doshas* are closely interlinked as the latter determines the former of an individual. Again Ayurveda believes that harmony of *Doshas* lead to healthy state and the opposite lead to ill health⁶. So indentifying and assessing the *Prakriti* of a particular individual by the help of a CDSS would definitely help to arrive at a clinical decision and help framing specific therapeutic regimen.

Brief History of Clinical Decision Support System:

The history of CDSS dates back to 1960 which began with clear cut objective to provide doctors with decision aids using

Artificial Intelligence-based medical diagnostic reasoning⁷. Use of IT in health care sector roots back to 1957 in India, the neurosurgery department of King Edward Memorial Hospital in Mumbai used to keep electronic patient records during that period⁸. But it is only after nineties the use of informatics felt clearly when a project called Indian health care project begun in 1994 in collaboration with Govt. of India, Apple computers and CMC in the state of Rajasthan. The project combined an IT device- the Personal Digital Assistance (PDA) - and support tools intended to reduce the time spent by an ANM (Auxiliary Nurse Midwife) in paper work, increase the accuracy of data collected and supplied by ANMs, ensure the availability of village level health care data in an electronic form, and provide ANMs with information that would help them to improve the effectiveness of the service⁹. Some of the early generation clinical decision support systems are listed below:

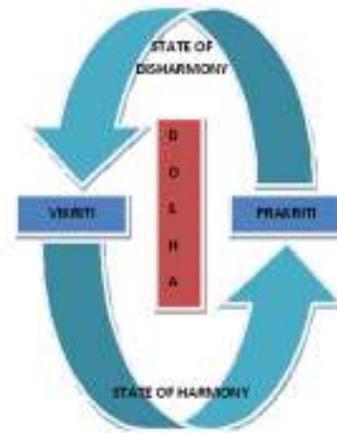


Figure No-1, Inter-relation of Dosha, Prakriti and Vikriti

Table No. 1, Examples of early generation Clinical Decision-Support Systems

Name of the CDSS	Year of Development	Developing Agency
De Dombal	1972	Leeds University, United Kingdom
INTERNIST I	1974	University of Pittsburg and later commercialized under the brand name Quick Medical Reference (QMR).
MYCIN	1976	Stanford University
DX Plain	1984	Massachusetts General Hospital

Difference between Clinical Information System and Clinical Decision Support System:

Sometimes Clinical Information System (CIS) and Clinical Decision Support (CDSS) are used interchangeably but a

meticulous look at both these concept reveal some subtle differences. Following table shows the difference between these two:

Table No. 2, Difference between CIS & CDSS⁽¹⁰⁾

	Clinical Information System (CIS)	Clinical Decision Support System (CDSS)
Reporting	Always structured	May be structured or unstructured
Computerization	With or without computer	Always computerized
Interactivity	Not interactive	Interactive
Regularity	Regular, Periodic	Ad-hoc, pragmatic
Setting up	Easy to set up with low cost	Costly to set up, operations to complex

METHODOLOGY

The conceptual framework designed in this study is based on the classical knowledge described in treatises of Ayurveda. The descriptions regarding *Prakriti* were obtained from the three major classics of Ayurveda known as Vrihatrayi that constitute Charaka Samhita by Acharya Charaka, Sushrut Samhita by Acharya Sushrut and Astang Hriday by Maharshi Vagavatta. Delineation of *Prakriti* was found in all these three treatises for each of the *Dosha* separately. But for the purpose of convenience the important characteristics were clubbed together in this study.

The final characteristics were obtained by using the following equations.

1. Descriptions by (Charaka + Sushrut + Vagavatta) = Vataja Prakriti
2. Descriptions by (Charaka + Sushrut + Vagavatta) = Pittaja Prakriti

3. Descriptions by (Charaka + Sushrut + Vagavatta) = Kaphaja Prakriti
4. Descriptions by (Charaka + Sushrut + Vagavatta) = Dwandaja Prakriti
5. Descriptions by (Charaka + Sushrut + Vagavatta) = Tridoshaja Prakriti

DISCUSSION

Broadly speaking, a decision-support system is an interactive, flexible, and adaptable computer-based information system developed specifically for supporting the solution of a non structured management problem for improved decision making. It utilizes data, provides an easy-to-use interface, and allows for the decision maker's own insights⁽¹¹⁾.

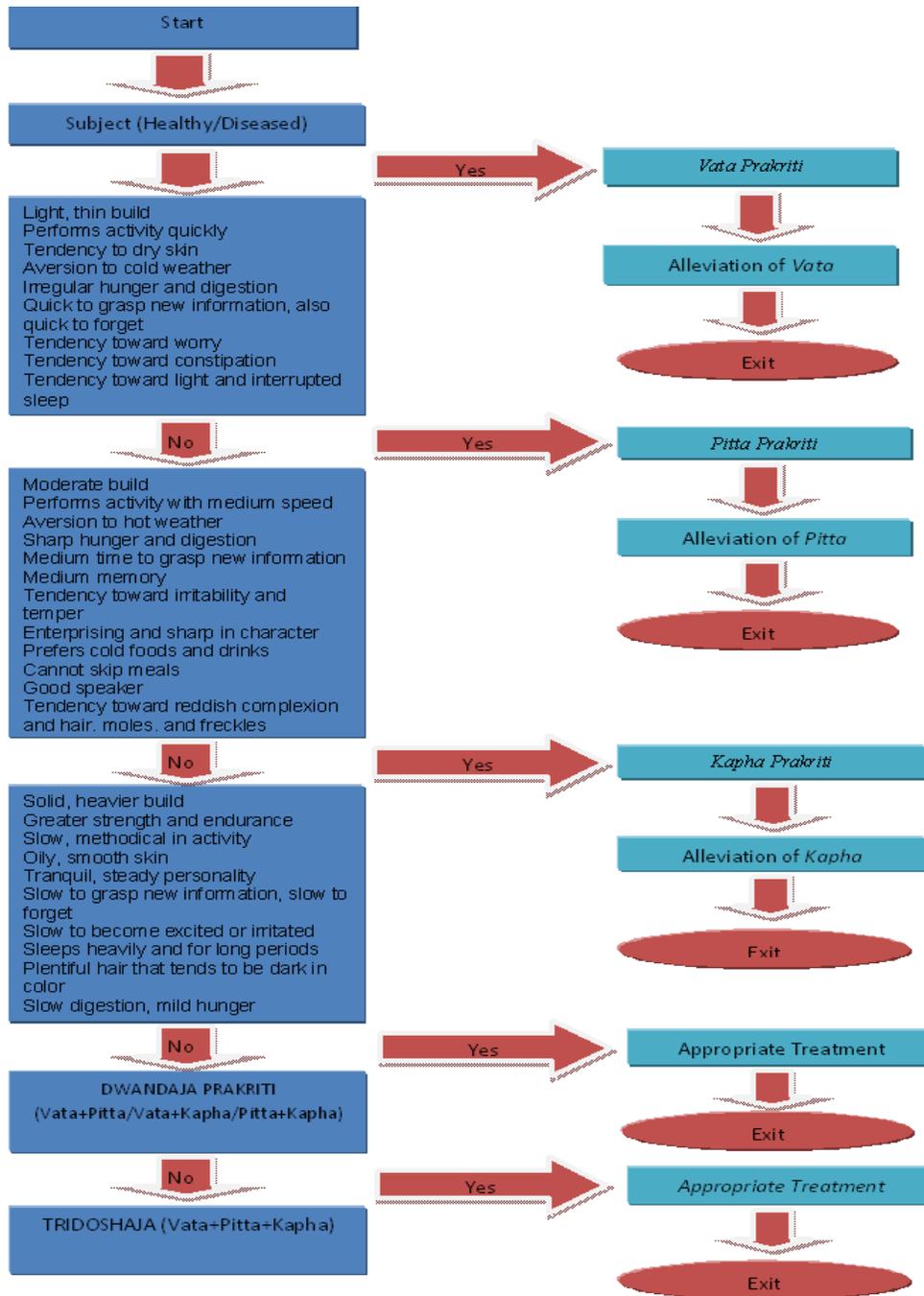


Figure No.1, Flow Chart Showing a Conceptual Framework of CDSS using Prakriti in Ayurveda

Clinical decision support systems provide clinicians, staff, patients, and other individuals with knowledge and specific, individualized information, intelligently filtered and presented at appropriate times, to enhance clinical performance and patient outcomes. It encompasses a variety of tools and interventions such as computerized alerts and reminders, clinical guidelines, order sets, patient data reports and dashboards, documentation templates, and diagnostic support.

⁽¹⁾ The up-to date medical knowledge implemented in CDSS is

primarily derived from evidence based clinical guidelines. AHRQ's National Guideline Clearinghouse (<http://www.guideline.gov>) is the principal resource for the latest guidelines spanning a wide variety of disease area. Unfortunately Ayurveda wisdom does not have such a computerized data base; hence the classical treatises are the only source. However in both these cases the clinical guidelines are usually disseminated as unstructured, narrative documents that often lack sufficient detail for computing. One

example can be quoted here to understand it better, a very simple guideline for breast cancer screening recommends “screening mammography, with or without clinical breast examination every 1-2 years for women aged 40 years and older. To convert this in to a computable form “screening mammography”, “women”, “age” need to be defined in standard medical terminologies.⁽⁷⁾ Similarly say, for example, a subjects attends a physician with “Tendency to constipation and Tendency to uninterrupted sleep” which are the characteristics of *Vata Prakriti* which also needs to be converted in to computational language. Here the “age”, “sex”, “Tendency to constipation” and “Tendency to uninterrupted sleep” of the subject need to be defined as per the standard Ayurvedic terminologies. The system thus formed can be helpful in identifying a particular *Prakriti* (Fig. 1). The process of identification of a particular *Prakriti* goes on till a particular *Prakriti* is identified. The system has an exit point at every phase; say, in the example mentioned above the subject identified with those characteristics need not go further and gets an exit there itself. If the characteristics are not matching then the system would direct to the next phase where the subject may be identified with *Pitta Prakriti* or *Kapha Prakriti* or *Dwandaja Prakriti* or *Tridoshaja Prakriti*. This is how the system function with multiple exit options wherever required. Once the *Prakriti* of an individual is identified the clinical decision can be taken based on the *Prakriti* and appropriate therapeutic regimen can be instituted based on the predominance of *Dosha*.

CONCLUSION

Prakriti is one of the unique concepts described in Ayurveda. It is determined by each *Dosha* or a combination of two or all the three. Analysis of *Prakriti* helps in assessing the predominance of *Dosha* or *Doshas* in an individual. *Dosha* imbalance leads to the development of disease hence better understanding of *Prakriti* helps in devising an appropriate therapeutic regimen for a particular subject. This function can be performed in an enhanced way by developing a clinical decision support system using *Prakriti* as a prime tool. This would help a physician in making effective, timely and

appropriate decision as and when needed. The study conveniently used some of the consolidated characteristics mentioned in classical Ayurvedic treatise which may be a limiting factor.

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