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.

**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.

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. 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, Panchamahabhutus (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. 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. 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 health. 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.

**INTRODUCTION**

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 reasoning. 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 period. 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 service. Some of the early generation clinical decision support systems are listed below:

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

<table>
<thead>
<tr>
<th>Name of the CDSS</th>
<th>Year of Development</th>
<th>Developing Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>De Dombal</td>
<td>1972</td>
<td>Leeds University, United Kingdom</td>
</tr>
<tr>
<td>INTERNIST I</td>
<td>1974</td>
<td>University of Pittsburgh and later commercialized under the brand name Quick Medical Reference (QMR).</td>
</tr>
<tr>
<td>MYCIN</td>
<td>1976</td>
<td>Stanford University</td>
</tr>
<tr>
<td>DX Plain</td>
<td>1984</td>
<td>Massachusetts General Hospital</td>
</tr>
</tbody>
</table>

### 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

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

### 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.
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 into a computable form “screening mammography”, “women”, “age” need to be defined in standard medical terminologies. Similarly say, for example, a subject 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 into 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.

REFERENCES


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