**APPLICATION OF DECISION SUPPORT SYSTEM IN HOSPITAL**

**BY**

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**ABSTRACT**

*One of the major advances in medical practice and healthcare is to incorporate decision support systems (DSS) in such practices to assist healthcare staff. The seminar paper is aimed at making a general understanding framework about the state of the art of the clinical decision support systems (DSS). The usage of DSS in clinical and healthcare settings is increasing. It has been shown that the incorporation of DSS can significantly improve health outcome indices. However, authorities shall establish standards and quality control systems to evaluate and integrate development and implementation procedures of DSS.*

**INTRODUCTION**

Human beings take decision all day long in mostly every action of her/his life. It is believed that optimum decision making is an art. Studies suggest that most people act much weaker than expected (Gregory & Edward, 2012). It could be said that all actions and affairs of human in any domain of life are the results of decision-making processes. Nowadays, deciding is a process which is related to problem-solving and therefore, decision-making is known as a problem-solving action. In other words, mentally, a problem occurs when the desired situation of the person appears that is different with the current situation. In such an occasion, individual primarily tries to change the current situation or condition in her/his mind, and then, willing to change the surrounding environment in order to achieve the desired goals (Robyn, 2018). Considering the need to take a suitable decision in a proper time, the presence of a system to provide people with aid in decision-making is of high value. Systems which do not only provide information, but also participate in even simple decision-making activities of any organization, are known as Decision Support Systems (DSS) (Marek, 2012). DSS is a computer-based system of information processing which is mainly developed to support organizational and enterprise affairs. Today authors believe that DSS could be told to any system that can support decision-making processes. In other words, DDSs are information systems which support organization, institutional, and/or enterprise activities that are in some way related to decision-making. DSSs are especially important when the situation is rapidly changing and anticipation and determination of future situations/conditions are hardly possible (Clark & Gregory, 2019).

Medical errors are one of the major problems in public health and are considered as threats to patients’ security. Patients’ security has a great role in healthcare. Authors have suggested the use of information technology advances as a suitable strategy to improve the quality of healthcare services and patients’ health. One of the most important and applicable information systems are clinical decision support systems (CDSS). In fact, one brilliant domain of the implementation of DSS is clinical decision-making (David, Heckerman & David, 2015). The domain of health is nowadays a wide area of information which is actually demanding for professional consultation and support, especially with every-day change and extension of medical knowledge in different aspects of healthcare system. These aspects include: diagnosis, medication, treatment, and follow-up in all three phases of primary, secondary, and tertiary prevention. Clinical decision support system (CDSS) is an interactive software which is developed on the basis of expert systems in order to assist and support the decision-making of physicians, health-care staff, and other personnel involved in broader domains of health-care systems. It could be noted that CDSS relates to health observations with health knowledge to improve health-care decisions which are taken by healthcare professionals. CDSS is the manifestation of the application of artificial intelligence in the public as well as private health-care systems (Samuel, 2012).

**Purpose of a Decision Support System IN HEALTH SECTOR**

CDSSs are considered as active systems of knowledge which are using two or more classification orders to generate case-specific medical suggestions for patients. This means that CDSS is indeed a DSS which focuses on knowledge management in health-care affairs to reach a medical advice according to few available issues (Judea, 2008). The main goal of designing current CDSSs is to assist physicians as well as other clinical professionals in some point in professional care systems. Therefore, the clinical experts and staff shall be in an active interaction with CDSS to use its capabilities to reach an optimum diagnosis, analysis, etc., according to patients’ data.

A decision support system (DSS) is an information system that aids a business in decision-making activities that require judgment, determination, and a sequence of actions. The information system assists the mid- and high-level management of an organization by analyzing huge volumes of unstructured data and accumulating information that can help to solve problems and help in decision-making. A DSS is either human-powered, automated, or a combination of both.

A decision support system produces detailed information reports by gathering and analyzing data. Hence, a DSS is different from a normal operations application, whose goal is to collect data and not analyze it. Theoretically, a DSS can be employed in various knowledge domains from an organization to forest management and the medical field. One of the main applications of a DSS in an organization is real-time reporting. It can be very helpful for organizations that take part in [just-in-time (JIT)](https://corporatefinanceinstitute.com/resources/knowledge/accounting/just-in-time-jit-method/) inventory management (Marek, 2012).

## What are computerised decision support systems?

The use of information technology (IT) to support everyday tasks has become a key characteristic of life in the 21st century. The increasing use of and reliance on satellite navigation systems by car drivers is an example of a computerised decision support system in everyday use. These computerised decision support tools also have considerable potential for use in clinical care settings (Andrew, 2011). These are in essence software applications that use patient data, a database of clinical knowledge and “conditional” logic (e.g. “if-then” and “do while”) to generate patient-specific recommendations related to care (Figure 1). Computerised decision support systems have been defined as *‘…* *computer programs that are intended to help healthcare workers in making decisions’*. Although they can also aid patient self-care, in this paper we focus on investigating the role of computerised decision support systems in supporting the management of patient care by healthcare professionals (Clark & Gregory, 2019).

Healthcare worker

Decision support

Figure 1: Components of computerised decision support systems (Clark & Gregory, 2019)

Computerised decision support systems can take several forms, depending on: the task they are designed to support; the approach to utilising patient data (which may involve direct input of data by professionals or, now more commonly, involving automated interrogation of existing electronic health records); the type of knowledge-base that is drawn upon; the inference mechanism that is employed; the types of outputs that are generated; and the ways in which these are communicated to healthcare providers.

## Classification of CDSS

Most of the time, CDSSs could be divided into two distinctive groups (Leonard, 2017):

1. **Knowledge-based CDSS:** Like all expert systems, most of CDSSs have three parts of knowledge base, inference engine, and mechanism to communicate. Knowledge base includes rules, regulations, and connection of interpreted data which often in the form of “if-then” rules. Inference engine synthesizes existing rules of knowledge base with patient’s data. Communication mechanism enables systems to show the results to operators and also enables operators to present inputs to system
2. **Non-Knowledge-based CDSS:** Those CDSSs which do not use knowledge-base, implement some kind of artificial intelligence named machine learning that allows computer learn from past experience and/or detecting figures from clinical data. Usually nonknowledge-based CDSSs are designed and developed on the basis of artificial neural networks and/or genetic algorithms.

Another classification, divides CDSSs into seven groups of data-access systems, data-analysis systems, future prediction data-analysis systems, computational-models based systems, presentation-based systems, optimization models-based systems, and suggestive-models-based systems (Haiqin & Marek, 2008).

In a recent research, authors have reviewed CDSS papers and classified them according to their methodologies as follows (Peter & Richard, 2013):

1. **Machine learning:** This class represents methodologies which implement algorithms that enable systems to learn from data. Such methods have an initial training phase to find trends in data sets of the given data base. Then, the system would be able to analyze new data with the same parameters and suggests predictions. This group includes artificial neural networks (ANNs), support vector machines (SVM), and logistic regression.
2. **Knowledge representation:** These methods concern the representation of knowledge and facts which are attained from clinical expertise to generate and produce a language of description which is comprehensible by machines (computers). This system uses automatic reasoning languages. This group contains ontology based systems, guide-line-based systems, and fuzzy logic systems.
3. **Information visualization (IV):** These methods are using visualization algorithms to encode abstract concepts and information. Such systems enable operators to visually inspect their decision's outcomes.
4. **Text mining:** These methods to some extent use the logic of content analysis to provide essential information from unstructured texts by implementing machine learning, linguistic, and statistical strategies. This group comprise information retrieval (IR), and natural language processing (NLP).
5. **Multi-purpose:** These techniques integrate various features, options, attributes, and characteristics of existing domains and categories to assist the decision making process. This group includes decision trees (DTs), and Bayesian logic.

**Advantages of a Decision Support System**

1. A decision support system increases the speed and efficiency of decision-making activities. It is possible, as a DSS can collect and analyze real-time data.
2. It promotes training within the organization, as specific skills must be developed to implement and run a DSS within an organization.
3. It automates monotonous managerial processes, which means more of the manager’s time can be spent on decision-making.
4. It improves [interpersonal communication](https://corporatefinanceinstitute.com/resources/careers/soft-skills/communication/) within the organization.

**Disadvantages of a Decision Support System**

1. The cost to develop and implement a DSS is a huge capital investment, which makes it less accessible to smaller organizations.
2. A company can develop a dependence on a DSS, as it is integrated into daily decision-making processes to improve efficiency and speed. However, managers tend to rely on the system too much, which takes away the subjectivity aspect of decision-making.
3. A DSS may lead to [information overload](https://www.forbes.com/sites/laurashin/2014/11/14/10-steps-to-conquering-information-overload/) because an information system tends to consider all aspects of a problem. It creates a dilemma for end-users, as they are left with multiple choices.
4. Implementation of a DSS can cause fear and backlash from lower-level employees. Many of them are not comfortable with new technology and are afraid of losing their jobs to technology.

**Conclusion**

Decision support systems are powerful tools integrating scientific methods for supporting complex decisions with techniques developed in information science, and are gaining an increased popularity in many domains. They are especially valuable in situations in which the amount of available information is prohibitive for the intuition of an unaided human decision maker and in which precision and optimality are of importance. Decision support systems aid human cognitive deficiencies by integrating various sources of information, providing intelligent access to relevant knowledge, aiding the process of structuring, and optimizing decisions.

**RECOMMENDATIONS**

DSSs should not be seen as a replacement to humans but rather augment their limited capacity to deal with complex problems, their user interfaces are critical. The user interface determines whether a DSS will be used at all and if so, whether the ultimate quality of decisions will be higher than that of an unaided decision maker.

Decision support tools need to be developed and refined in conjunction with clinicians if these are to have the desired impact on effectiveness; their cost-effectiveness and potential disruption to user workflows should also be considered.

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