Clinical Decision Support System in Oncology: Oncologist's Perceptions and Suggestions

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Abstract

Background*: A clinical decision support system (CDSS) is a health information technology system that is designed to provide physicians and other health professionals with overall information about the patients and their health record or in other words clinical decision support (CDS), i.e. assistance with clinical decision-making tasks. **Purpose**: The main aim of the study was to assess the knowledge, perception and expectations of oncologists from North India (particularly J&K) about the CDSS. **Methodology**: 100 Oncologists of various hospitals and research institutes of North India were selected as participants for the present survey. A well-prepared questionnaire was provided to the participants containing the questions related to information, perception and prospects towards CDSS. The participants were asked to mark their response on a 5-PointLikert Scale i.e. from Strongly Agree to Strongly Disagree. The time motion study was also conducted to identify the issues related to the retrieval of patient information and domain knowledge. **Results**: The Oncologists had significant knowledge of CDSS and their perception towards CDSS was found to be substantial. The Oncologists felt the need of implementing CDSS in their hospitals so as to increase the healthcare facilities, speed-up the treatment process and reduce the healthcare cost. The Oncologists expected that the CDSS should have the characteristics to store the patient's clinical history, practice guidelines and updates related to cancer care. The time motion study showed that the Oncologists spend most of their time in accessing patient information during patient evaluation because they don't have any web based database to directly access the information, rather have to largely depend on printed text. **Conclusion**: There is a huge demand of implementing CDSS in cancer hospitals and research institutes so as to make the cancer treatment and research more effective, affordable and less time consuming.*

Keywords*: Clinical Decision Support System; Cancer; Oncologist; Questionnaire.*

I. INTRODUCTION

Cancer is one of the most common causes of death, with nearly 7 million deaths each year worldwide. Right now 24.6 million people are living with cancer, and by 2020, it is projected that there will be 16 million new cancer cases and 10 million cancer deaths every year [1]. Cancer begins when cells in a part of the body start to grow out of control. Cancer control and prevention is regarded to be an important but challenging task for the doctors, researchers and hospital establishments. The main goal of cancer control and prevention is to reduce the incidence of cancer and also to improve the quality of cancer patient[2, 3]. In order to achieve this goal, a doctor has to make a quality decision in formulating the diagnosis and treatment strategy, which is possible only when he gathers the sufficient information from the patient and other sources[4]. The potential of Information and Communication Technology(ICT) is always looked upon by oncologists and healthcare professionals as a method for improving the accessibility of patient information and domain knowledge to improve the clinical outcome of the cancer patient[5].These technologies have the potency to alleviate or facilitate communication and exchange of information between the cancer patients and the healthcare professionals with an ultimate objective to enhance the benefits to both the stakeholders, especially the patient. These technologies are recognized as a supportive tool to save time and money, increase convenience and choice, obtain timely information, and improve decision making during patient care[6].

Clinical Decision support systems (CDSS) is an important application of ICT which helps the doctors in collecting patient information and clinical knowledge related to the respective domain for making diagnostic and therapeutic decision. The system also assists in clinical coding and documentation, authorization of procedure, clinical diagnosis, referral, treatment strategy, condition-specific guidelines, and promoting the use of best practices[7]. It also helps in minimizing the practice variation and improving the patient care as well as helps in creating a marked surface throughout the healthcare industry[8]. It also assists in management of various other activities such as referral, diagnosis, classification and staging, treatment and follow-up of the patient specific to cancer disease. CDSS also helps in continuously monitoring the patient treatment process. The increasing technology in healthcare suggests the necessity for advanced and dependable clinical information systems with decision support capabilities for quality decision making in healthcare delivery system. But before the implementation of such system, it is required to understand the doctor's opinion as the acceptability of any such information system in the healthcare set-up largely depends on the positive attitude of the medicinal practitioners so as to use it for quality decision making in patient care[9-14]. To make the

system more acceptable and effective in the healthcare delivery, doctor's perception and expectation towards the CDSS must be evaluated and taken into account. This helps in choosing the best possible content and tool for the development of the system[15-17].

II. METHODOLOGY

Study Design: The present study was designed to evaluate and identify the level of awareness, perception and expectation of oncologists from North India towards CDSS using a tested tool by selecting oncologists from different hospitals. A well-established descriptive method of research was used for the study[18].

Study Setting: The participants (oncologists) were selected from 10 different Cancer Hospitals and Research Centres of North India (particularly J&K).

Sample Size: 100 oncologists from four different regions of North India *viz*. Punjab, Jammu, Kashmir and Ladakh were selected for the present study, based on the availability and convenience and also as per the qualification of the Oncologist.

Inclusion Criteria: To obtain pertinent information, certain inclusion criteria were drawn. The participants with MD or MS and 3years of working experience in the oncology department qualified for the study. This qualification assured that the participants understood the role of information support services in their practice and be able to give valuable feedback in this respect. The oncologists who were not willing to participate in the study were excluded.

Data Collection Tool: To collect the data from the Oncologists, a corroborated questionnaire was used which consisted of three parts:

Statistic Details; Awareness, Perception and Expectation towards Clinical Decision Support System:

The oncologist's perception towards the CDSS was evaluated by using 8 parameters in the questionnaire where the oncologists were asked to mark in a scale from 1 to 5 (Strongly Agree to Strongly Disagree). To understand the expectation of oncologists from the CDSS in terms of quality decision making, coding, documentation and patient care, the oncologists were asked to rate their expectation using a checklist consisting of 14 components where the oncologists were asked to mark their response in a scale from 1 to 5 (Strongly Agree to Strongly Disagree). The existing workflow has also been observed to determine the total time for collecting and distributing the patient information to the oncologists and also the issues related to the accessibility of clinical knowledge. The oncologists were also asked to list out the areas of improvement in terms of information support service in their practice.

Methods of Data Collection: The proper consent from the concerned hospital authorities was taken before the selection of Oncologists for the present study. The Oncologists were first briefed about the research and its objectives and the purpose of survey. An informed consent was obtained from the Oncologists for being the part of the study where the data was collected by distributing the questionnaire among those who responded. During the process of data collection, the work flow pattern and total time taken with respect to the documentation, retrieval and access of patient information and clinical knowledge were also noted down.

Statistical Analysis: Statistical Package of Social Sciences(SPSS) 16.0 version was used to analyze the data. Chi squaretest was performed and $P<0.05$ was considered significant. The average time for collection and distribution of patient information to the oncologists were also calculated to understand the issues related to the access and availability of information and clinical knowledge and to suggest the better CDSS for improving the information support service process.

III. RESULTS AND DISCUSSION

A. **Demographic status of the Oncologists**:

Sex:100 oncologists from 10 hospitals and research centres of North India participated in the study. Out of the 100 oncologists, 65% were male and 35% were female (Figure 1).
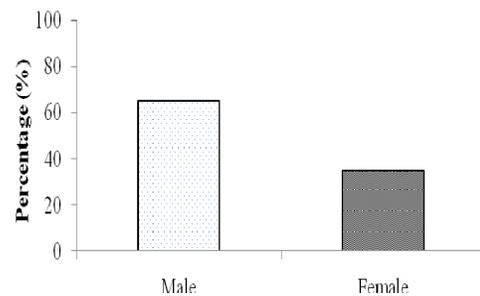

Figure 1: Sex-wise distribution of oncologists

a) **Age**: The age-groups were divided into the intervals of 5 years. The maximum number of oncologists (42%) were found in the age group of 41-45 (Table 1). 15% of oncologists were in the age group of 36-40 followed by 13% under 31-35 age group, 12% in 51-55 age group,10% under 56-60 group and 8% under 46-50 group (Table 1).

Table 1: Age-wise distribution of oncologists

Age group (in years)	Frequency	Percentage (%)
31-35	13	13
36-40	15	15
41-45	42	42
46-50	8	8
51-55	12	12
56-60	10	10

b) **Department**: Table 2 represents the department-wise distribution of the oncologists. Majority of the oncologists were found to be from the surgical oncology department (42%), followed by medical oncology (32%) and radiation oncology (26%).

Table 2: Department-wise distribution of oncologists

Department	Frequency	Percentage (%)
Medical Oncology	32	32
Surgical Oncology	42	42
Radiation Oncology	26	26

c) **Designation**: Table 3 represents the designation-wise distribution of the oncologists. Of the total 100 oncologists, 35 were Associate Professors followed by 24 Assistant Professors, 21 Consultants and 20 Professors, respectively (Table 3).

Table 3: Designation-wise distribution of oncologists

Designation	Frequency	Percentage (%)
Professor	20	20
Associate Professor	35	35
Assistant Professor	24	24
Consultant	21	21

d) **Experience:** The majority of the Oncologists (40%) had 11–15 years of experience, 32% under 5–10 years, whereas, 15% of the Oncologists had 16-20 years of experience and 13% had 21-25 years of experience in healthcare, research and teaching (Figure 2).
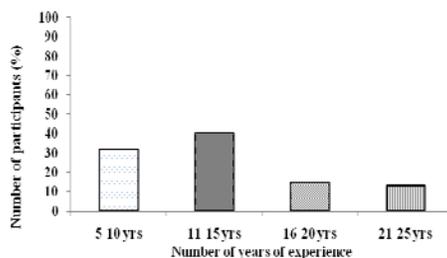

Figure 2: Experience-wise distribution of Oncologists

B. **Perception of Oncologists towards CDSS:**

The perception and suggestions of healthcare professionals are of primary importance in the implementation of CDSS in hospital setup. The oncologists who participated in the survey offered various opinions about the CDSS in healthcare practice. The response of the oncologists towards CDSS is summarized in Table 4. 90% of the oncologists agreed to the fact that the implementation of CDSS will increase the productivity of the hospital and delivery of best possible treatment. This may be ascribed to the fact that majority of the oncologists

were quite aware of the benefits of CDSS in their respective fields. Our results are in agreement with previous studies [19-21] which suggested that most of the CDSS improved the clinician performance and resulted in better patient outcome. When asked whether the implementation of CDSS will create hassles in their work, majority of the Oncologists (62%) were found to disagree whereas only few of them (15%) felt that CDSS may create hassles and rest (23%) showed no opinion (Table 4).

Table 3: Opinion on Clinical Decision Support System

S.No.	Implementation of CDSS will:	SA	A	N	D	SD
1.	Increase the productivity of hospitals	66%	24%	6%	3%	1%
2.	Create hassles for clinical staff	5%	10%	23%	21%	41%
3.	Do a job better than the people	57%	26%	7%	8%	2%
4.	Decrease hospital costs in the long run	62%	24%	4%	7%	3%
5.	Mean less work for clinicians	25%	52%	13%	6%	4%
6.	Upgrade job functions of non-medical staff	15%	42%	34%	5%	4%
7.	Reduce the doctors control over medical practice	7%	13%	22%	37%	21%
8.	Is unavoidable in healthcare practice	37%	43%	11%	6%	3%

SA= Strongly Agree, A= Agree, N= No Opinion, SD = Strongly Disagree, D=Disagree

When the oncologists were asked whether the CDSS will reduce the cost in the long run, most of the Oncologists(86%) agreed, 10% disagreed and 4% of the oncologists had no opinion. When asked whether the CDSS will reduce the workload for clinical practitioners, 77% of the oncologists agreed, 6% disagreed, and 13% did not opine. Our results are supported by the previous studies [21-23] which reported that the CDSS had significantly decreased the clinician's prescription cost and improved their prescription efficiency. When asked whether the CDSS will upgrade the job function of non-medical staff, most of the Oncologists (57%) agreed, while as 34% had no opinion, and the rest (9%) disagreed. Most of the Oncologists (58%) were of the opinion that the implementation of CDSS will never reduce their control over medical practice as any technology cannot replace human work, 22% of the total Oncologists did not have any opinion and only 20% of them agreed with the same. When asked whether CDSS will be helpful in making best possible decision during patient care, 80% of them agreed

whereas 9% disagreed and 11% did not opine(Table 4).Our results are supported by the findings of Rosen bloom et al, 2004 which suggested that the clinicians were satisfied with the computer provided order entry and reported that their efficiency in terms of quality patient care, order entry has been improved. They also suggested that the CDSS is also assisting them in medical training[24].Taking together, our results showed that the Oncologists with were highly interested in implementing CDSS in their hospital infrastructure so as to get maximum benefit out of this application for healthcare. Younger generation of oncologists was more enthusiastic as compared to older generation being more aware of the computer technology.

C. Expectation of Oncologists from CDSS:

Before designing and implementing any ICT application in a hospital setup, it is important to identify the expectations and needs of the clinical practitioners[25]. One of the main of our study was to understand the expectation of oncologists from the CDSS.

a) **Expectation with regard to Clinical Decision Making:**

Healthcare professionals can make best possible clinical decision only when they have complete and accurate patient information and domain knowledge during the patient encounter. That information also contributes in updating knowledge and planning better therapy and care. In the present study, all the oncologists agreed with the fact that CDSS should have the facility to provide various clinical knowledge and treatment strategies to the end user in quality decision making. Most of the Oncologists (80%) showed their agreement and very few(20%) were not sure about the role of CDSS with respect to the etiological diagnosis and therapy. 95% of the Oncologists desired for features where the proposed system will aid them in updating the clinical knowledge for planning the treatment and care (Table 4).

Table 4: Expectations with regard to Clinical Decision Making:

	SA	A	N	D	SD
Providing various clinical knowledge and guidelines	80%	20%	0%	0%	0%
Answering questions concerning medical knowledge	20%	60%	10%	7%	3%
Correlating patient condition with clinical knowledge	8%	80%	10%	1%	0%
Finding etiological diagnosis and therapy goal easier	80%	10%	10%	0%	0%
Updating the knowledge of healthcare team by providing reviews of scientific literature and current updates	10%	80%	8%	2%	0%

SA= Strongly Agree, A= Agree, N= No Opinion, SD = StronglyDisagree, D=Disagree

b) **Expectation with regard to Documentation and Statistics ofPatient Information:**

The implementation of information system in clinical practice has always been better of healthcare professionals as it reduces the time in medical documentation and clinical coding and increases their time for patient care and examination. In the present study, we asked the Oncologists about their expectation from the proposed system in terms of medical documentation, clinical coding, statistic and recording of investigation results. In response to this,98% of the Oncologists wanted to have an automated clinical coding and documentation features in the proposed system. The majority of the Oncologists i.e. 95% felt that the system should have the features in generating variety of statistical results for reporting and research. All the Oncologists agreed to have certain features where they can easily interact with each other using the same system and receive the investigation as well as therapy results without any delay (Table 5).

Table 5: Expectation with regard to Documentation, Patient Information & Statistics

Clinical Decision Support System should::	SA	A	N	D	S D
Support in clinical coding and documentation	20%	78%	2%	0%	0%
Produce a variety of statistical analysis	40%	55%	5%	0%	0%
Improve communication and cooperation	10%	90%	0%	0%	0%
Make results of an investigation easier	20%	80%	0%	0%	0%

SA= Strongly Agree, A= Agree, N= No Opinion, SD = Strongly Disagree, D=Disagree

c) **Expectation of oncologists with regard to Patient Care:**

CDSS helps the healthcare professionals in attaining the best patient outcome and maximum patient satisfaction by lowering the cost of care, improving the clinical outcome, quick information retrieval and minimizing the waiting time of the patient. The healthcare professionals also get benefited with this in promoting evidence based medicine. In view to this, 90% of the Oncologists agreed that the system should have an automated feature to quickly access the patient's investigation details. They also were of the opinion that the automation of this process will prevent the patient data from misplacing and will directly contribute in reducing the cost of healthcare. About 95% of the Oncologists felt that the system should have certain features to assist them in retrieving complete, accurate and adequate patient information and domain knowledge related to cancer for improving the clinical outcome of the patient. All the Oncologists wish to have selective retrieval of patient information and domain knowledge. They also felt that the system should satisfy their day to day reporting activities such as administrative, clinical and reporting to National Cancer Registry Office. They felt the need of such

system in getting access to all the patient information andthe status of the patient during follow-up.Evidence base medicine is the use of current medical knowledge andpatient's clinical evidence to make quality decision during patient'streatment. In this view, 85% of the respondents expected to have thisfeature into the system but 15% of them were not sure whether thesystem will really assist them in improving the evidence based medicine(Table 6).

Table 6: Expectation with regards to Patient Care

Clinical Decision Support System should:	SA	A	N	D	SD
Reduce the cost of healthcare	20%	70%	10%	0%	0%
Help in improving the clinical outcome of patients	20%	60%	10%	0%	0%
Make seeking specific information from patient records	30%	65%	5%	0%	0%
Help in better reporting and follow-up of adverse events	20%	80%	0%	0%	%
Promote evidence based healthcare practice	15%	70%	15%	%	%

Strongly Agree, A= Agree, N= No Opinion, SD = Strongly Disagree,D=Disagree

All the Oncologists agreed to the fact that CDSSshould be implemented in all the Cancer Hospitals of North India and should have theprovision where the decision taken by the Doctor based on theinformation provided by the system should automatically getstored into the database for future reference (Table 7).

Table 7: Overall opinion on Clinical Decision Support System

Parameter:	Yes	No
Do you think that the CDSS should be implemented and practiced in all healthcare facilities for quality decision making and quality healthcare?	100%	0%
Do you think the CDSS should have the provision to automatically store the decisions made as a case base, which can be referred to later during a similar case?	100%	0%

IV. CONCLUSION

The present study suggests that the Oncologists were very optimistic in implementing the CDSS in the healthcare practice in North India. The majority of the Oncologists were of the opinion that the implementation of CDSS will reduce the hospital cost in the long run, lessen the workload in terms of recording and reporting, promote the job functions of non-medical employees and store the information and the history of patients for future reference. As J&K state is more prone to colorectal and breast cancers due to a number of genetic and other environmental factors,

the major concern of Oncologists of J&K was to reduce the time in accessing the patient information and clinical history so as to suggest the best possible treatment, and they felt that the implementation of CDSS will definitely support them in doing so. The Oncologists further opined that the CDSS will support them in easydocumentation, statistical analysis and also assist them inimproving the clinical outcome of the patient. In conclusion, all the Oncologists suggestedthat in order to increase the productivityof the hospital, the CDSS should be implemented in all thehospitals.

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