

## Chapter 12

# Conclusions and Future Work

The aim of this research has been to design and develop a customized decision support system in Oncology and provide a simplified solution to the Oncologist in access of patient information and domain knowledge for quality decision making in cancer care.

### 12.1 Conclusion

Clinical Decision Support System is an application to improve the clinical performance and productivity of the clinicians and hospital; but, the acceptance of these applications is dependent on the presentation of information and domain knowledge in timely and appropriate manner to the end users. The provision of patient information and domain knowledge in a timely fashion can contribute the improvement of patient care and performance of the healthcare professionals.

Breast and Cervical cancers are widely prevalent and leading causes of death among women. Cancer care is subjected to the availability of patient information and domain knowledge at the fingertip of oncologists for the continuity of care; but, the existing systems in practice are either complicated or

they focus on the specific areas/modalities rather than on the complete domain. Thus the available information may not be completely useful in quality decision making during patient care. Most of the existing systems, related to the accessibility of patient information and clinical knowledge, are manual in nature and are not standardized, which leads to the Oncologists spending more time working with the same and less time available for patient care.

Considering the above, the objective of this research was to provide a simplified solution to completely support the oncologists with complete, accurate, adequate and timely patient information and domain knowledge for quality decision making during patient care and evaluation.

The successful implementation and acceptance of IT applications is only possible when the awareness and perception of the healthcare professionals are identified and their requirement and expectation are being fulfilled. The similar strategies are implemented in the present research and the findings indicated that the oncologists are enthusiastic about the implementation of such an application. The major concern of the oncologists was the accessibility of the content of the application with minimal time compared to the existing systems in practice. They stressed on the standardization of the documentation and retrieval of domain knowledge for patient care, health research, and for various reporting purposes.

When probed to understand the expectations of the Oncologists, the findings revealed that most of them expected that the implementation of clinical decision support system should decrease the hospital cost in the long run, reduce their work load in terms of documentation and reporting, upgrade the job functions of non-medical personnel, and do the job better than manual system. The respondents felt that implementation of clinical decision support system is unavoidable in healthcare practice in today's condition and will not

reduce their control over medical practice in any way. Infact, CDSS will improve their effectiveness and efficiency. On probing their general awareness, it was found that the Oncologists felt that the CDSS will only assist in decision making and will not displace the clinicians. They felt that the implementation of the system in future will definitely increase the productivity of the hospital and it should be implemented in all the hospitals.

The Oncologists also commented that the system should support them in easy documentation, statistical analysis and also assist them in improving the clinical outcome of the patient. The suggestions given by the respondents were mainly related to the strengthening of the knowledge base. They suggested various text materials in terms of textbooks, journals, practice guidelines and websites related to oncology practice which are commonly followed by them and inclusion of which will streghen the knowledge base.

Considering these requirements as a priority, the OncoSys has been designed and developed to completely support the Oncologist in patient care and evaluation. To achieve the total acceptance and sustainability of OncoSys, all the requirements of the Oncologist identified during the survey were incorporated into the system. OncoSys is a web enabled clinical decision support system consisting of **Patient Database** to capture the demographic and clinical events that occur in care of a cancer patient with automated ICD-Oncology-3rd Version and AJCC TNM-Staging ; **Knowledge Base** to create a warehouse of knowledge related to oncology domain; **Search Engine** to search domain knowledge based on two criteria such as the latest evidence and review article; **Case base** to create a user profile to store all the transaction details of the end user and **Statistical Analysis** module to generate various statistics related to patient care.

A user acceptance test was conducted after implementation of OncoSys and

was supported by a series of demonstration to the Oncologists, where the detailed features, functionality and use of OncoSys related to Patient Database, Search Engine, Knowledge base, Case Base and Statistical Analysis were explained to them. The result indicated that all the respondents were fully satisfied with the OncoSys and they agreed that the system fulfills all the criteria to be a good clinical decision support system. They also observed that the content of the modules, automated ICD-Oncology-3rd Version and AJCC TNM Staging System will completely support them in standardized documentation and instant access of patient information and domain knowledge and also in performing various statistical analyses for reporting purposes for National Cancer Registry Office.

The knowledge base and search engine were found most impressive by the Oncologists and they commented that these features can assist them immensely in sharing of knowledge with their colleagues; in accelerating the searching of domain knowledge related to Oncology; for promptness in problem solving related to multidisciplinary decision making; and in updating the knowledge of the healthcare team.

The overall acceptance level was found to be high. The only recommendation received from the respondents was that the OncoSys is to be expanded to support the entire Oncology domain. This is the scope for future work in terms of scaling up the OncoSys.

## 12.2 Future Work

Researchers always come across a number of open questions that allow them to look forward and pursue the course of action in making the research outcome more feasible and acceptable.

The present research has also received various suggestions and recommendations from the Oncologists for the further expansion of the OncoSys for other domains of Oncology. This is taken as a future work to scale up the OncoSys as a single application for the entire Oncology domain. One step in this direction would be to identify the further requirement from many more expert oncologists for patient database, knowledge base and also for statistical analysis. This input could help to further improve the presentation of information for better and more efficacious patient care.

Knowledge base document view can be enhanced by making it to view in browser itself instead of downloading a copy of it. Document management system can be incorporated inside KB so that every user can categorize the documents when the size grows up. Search engine can store more information from web pages by grabbing document creation/modification dates. This will help in retrieving the latest knowledge in any topic. Security of the application can be increased by encrypting information of patient or unique keys that is passed between web pages to avoid code injection.