Distributed Reuse of Knowledge in a Computerized Decision Support System for Bone-Marrow Post-Transplant Care over the World-Wide Web

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Overview. The Computerized Decision Support System project (CDSS) develops and evaluates a web-based computer system for bone marrow transplant (BMT) long-term follow-up (LTFU) at the Fred Hutchinson Cancer Research Center (FHCRC). The CDSS system aims at providing an information and knowledge resource capable of assisting the clinical work of users having very diverse expertise levels in BMT post-transplant care. It is made available on the World-Wide Web (WWW) both as an Intranet and an internet network, with appropriate security guards, so that the knowledge and assistance sharing depends mainly on the users' expertise level, and as little as possible on their geographical and/or institutional location. The final goal of the system is to promote the central importance of the patient care, by providing useful information to the right person at the right time.

Domain. The largest BMT program in the world is located at the Fred Hutchinson Cancer Research Center. About 2,000 physicians from all over the country address patients to the FHCRC for a BMT. After discharge from the FHCRC, the home care-providers following discharged BMT patients contact the LTFU experts for diagnosis and treatment advice whenever a complication happens, or for long-term treatment of early complication onset.

Tasks. The CDSS system proposes to assist the different users (home care-providers, LTFU staff, patients and their families) in the access to its knowledge-base, depending upon their authorization level, in the performance of a set of tasks adapted to their expertise level. These tasks include: **information retrieval, reactive and predictive problem-solving, patient administration, staff education** and **clinical research assistance.** Several other tasks, implementing artificial intelligence methodologies, are performed by the system, but for its internal use only, such as case-based reasoning [1], knowledge acquisition and machine learning.

Knowledge-base components. The knowledge-base [2] is a network of entities, where entities are nodes, connected by links. It is organized around a comprehensive model of the domain, built upon a domain independent model and the UMLS (concepts, attributes and relationships). It includes:

1 Guidelines: CDSS has three levels of guidelines: general medical guidelines, FHCRC guidelines and LTFU guidelines.

2 Bibliographic entities: LTFU publications.

3 Cases: cases are problem-solving entities. Two main case-bases are in the system: a patients case-base, where cases are patient specific problem-solving processes, and a users casebase, where cases are users' problem-solving traces. The patients case-base is composed of two complementary types of cases: prototypical patient cases (described by the experts) and actual patient cases (real patients cases).

4 Protocols: LTFU treatment research protocols.

Reuse of knowledge. Reusing knowledge is performed for all the tasks, but with a different procedure. Nevertheless, all the tasks share the same reasoning cycle, starting by the presentation to the system of an initial problem to solve, which can range from a diagnosis or treatment to an information search, and composed of abstraction, retrieval, reuse, repair and memorization steps. The **reuse** of the knowledge entities retrieved differs depending upon the task performed: a straight-forward presentation of texts or an adaptation of the solution encoded in patient cases retrieved to fit the new problem to solve.

Conclusion. The CDSS project is a three years project, supported in part by grant R01HS09407 from the Agency on Health Care Policy. Its evaluation will encompass not only computer dimensions (such as efficiency and user-friendliness) but more importantly the impact of the system on the quality of care, the patients quality of life, and the cost of care.

References
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