DIAGNOSTIC PATHOLOGY

ORAL PRESENTATION

Automated decision algorithms in prostate cancer

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A diagnostic decision support system (DDSS) is defined as a methodology that provides guidance in situations involving complex decision sequences. DDSSs result in a systematic, ordered, and exhaustive evaluation of evidence and weighting of individual items of evidence as they are combined to form the basis for a final decision. Most DDSSs provide a numeric measure of confidence in the final decision or diagnostic recommendation. The decisive advantage of DDSSs is the ability to process descriptive symbolic information, in contrast to systems limited to the handling of numerical information only for which extensive analytical procedures are already established. Most human knowledge and insight related to diagnostic and prognostic evaluation exist in symbolic form as concepts and linguistic terms, so the DDSSs have facilitated systematic evaluation of evidence to provide diagnostic and prognostic decision support.

DDSSs may be implemented as inference networks (or Bayesian Belief Networks – BBNs), automated reasoning systems, case-based reasoning systems, or expert systems. In inference networks and automated reasoning systems, the emphasis is on uncertainty assessment of a given decision sequence. In case-base reasoning, the emphasis is on prognostic assessment for an individual patient. In expert systems, the emphasis is on diagnostic or prognostic assessment, by making available a comprehensive knowledge base of facts and professional experience. However, even though the emphasis is slightly different in these kinds of decision support systems, much of the methodology is shared.

A BBN consists of a decision node for the diagnostic alternatives and of evidence nodes for the diagnostic clues. Each clue is observed, rated, and assigned to a function with a given probability. The evidence is then forwarded to the decision node via a conditional probability link matrix. At the decision node, the belief in each diagnostic alternative is accumulated. A series of BBNs have already been successfully developed for prostate and non-prostate neoplasms (7-13) including comparing cancer with benign lesions and those with prostatic intraepithelial neoplasms.

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