A Decision-support Program for the Analysis of Sexual Maturation – A Novel Approach

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Abstract

Introduction: Adolescents represent roughly 21% of the population, constituting a group with low demands for health services, but pubertal development evaluation represents a challenge to primary care physicians (PCP), who provide the first line of medical attention. Objective: Provide non-specialist medical practitioners with information on puberty and sexual maturity, through a user-friendly, knowledge-driven instrument for point-of-service (POS) use. Methodology: develop a Java™-based, decision-making system related to puberty and sexual maturity capable of running on Mac™, GNU Linux and Windows™ OSs. Results: The clinical decision support system (CDSS) comprises a Java™-based inference engine with 127 production rules and graphical user interface. Based on the construction of the knowledge base a 591-entry glossary was generated for user help. Information was evaluated by comparing the results generated by the system and those reported by 9 specialist medical practitioners. The evaluation rendered by specialists and the system was statistically significant by 1% with 77% of the specialists and their respective groups. The user interface was positively evaluated regarding all aspects by 55 physicians. Conclusion: We have collected information on puberty and sexual maturity and used that to develop an CDSS comprised of 127 production rules. The system was evaluated and displayed adequate performance when compared with diagnoses reported by specialist medical practitioners, and its user interface was validated by physicians. Due to the fact this is an open-source, Java™-based system, we believe it is suitable for deployment in the public healthcare system.

Keywords:

Expert system, Decision-support system, Clinical decision-support system, Knowledge-based decision-support system, Sexual maturation, Puberty, Anthropometry.

Methodology

PADMAS1 is a CDSS written in Java™, with a specifically developed shell. Inside the shell are the logical operators and expressions system and the boilerplate regulatory mechanism. Databases and knowledge-rules are located outside the shell.

The collection of information has been conducted by querying related bibliography at Medline, PubMed, Google Scholar databases. The knowledge base surveyed has been translated into computer language by application of production rules. To validate the knowledge base, all medical diagnoses generated by the CDSS for 30 test cases were compared with diagnoses reported by 9 specialist medical practitioners. These results were statistically treated for specialist-CDSS agreement using Cohen's Kappa coefficient and their significance tested with Student's T-test. A 5% probability (P=0.005) was adopted for significance level. The system's interface was validated by 55 physicians who answered standardized forms on system satisfaction.

Results

An open-source, Java™-based, decision-making system related to puberty and sexual maturity capable of running on Mac™, GNU Linux and Windows™ OSs was developed. The CDSS comprises an inference engine with 127 production rules and graphical user interface. Based on the construction of the knowledge base we generated a 591-entry glossary to help users. Information was evaluated by comparing the results generated by the system and those reported by specialist medical practitioners. The evaluation rendered by specialists and the system was statistically significant by 1% with 77% of the specialists and their respective groups. The user interface was positively evaluated regarding all aspects.

Conclusion

The system was evaluated and displayed adequate performance when compared with diagnoses reported by specialist medical practitioners, and its user interface was validated by physicians. Due to the fact this is an open-source, Java™-based system, we believe it is suitable for deployment in the public healthcare system.