Explanations for a Hypertension Decision-Support System
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1 ATHENA, A HYPERTENSION DECISION-SUPPORT SYSTEM
The EON architecture, developed at Stanford Medical Informatics, consists of a set of general components that work together to provide decision-support to physicians for guideline-based medical therapy [1]. A clinical application based on the EON architecture is ATHENA (Assessment and Treatment of Hypertension: Evidence-Based Automation), a project at the VA Palo Alto Health Care System [2]. ATHENA evaluates clinicians’ compliance with JNC6 and VA hypertension care guidelines when the clinicians interact with an automated decision-support system. Using the EON guideline model, we created computer-interpretable representations of the hypertension guidelines. The ATHENA application interprets the guideline model using the relevant patient data, and provides patient-specific recommendations for clinical management of hypertension.

2 EXPLANATION ISSUES IN ATHENA
ATHENA provides explanations that justify its recommendations to the clinician. The explanations provide insight into the workings of the system. Thus, they can enhance the user-acceptance of the system, and assist developers in debugging the system. In ATHENA, the information required to generate explanations is distributed among different sources: (1) the relevant patient data, (2) the knowledge base that contains the hypertension guideline model and general clinical terms, (3) inferences made by the EON guideline interpreter such as what to assume when patient data are missing, and (4) the guideline document, which includes the JNC6 hypertension guideline report as well as the VA’s interpretations and modifications. The major issues in generating explanations are how to specify what information should be part of an explanation, how to integrate the different pieces of information consistently, and how to present the information coherently.

3 EXPLANATIONS USING WOZ
We developed ATHENA’s explanation facility based on WOZ, a multi-client framework that uses rhetorical argument structures [3]. The core aspect of WOZ is the explanation strategy that defines what pieces of information should constitute an explanation for a recommendation. WOZ uses argument structures to identify the different components of an explanation, such as the system’s recommendation itself, the medical evidences that support the recommendation, the strength of the recommendation, the evidences that contradict the recommendation, and the patient data used in computing the recommendation. The argument structures are templates for fashioning a convincing explanation for the user. We group the recommendations that ATHENA makes into classes. For example, all drug recommendations are grouped into one class. Then, for each class, we specify an argument structure that identifies the information required to explain all the claims in that class. These argument structures are stored in a knowledge base.

At runtime, when a clinician requests an explanation for a recommendation, WOZ identifies the class that the claim belongs to. It then selects from the knowledge base the argument structure associated with that class. WOZ substitutes the abstract descriptions of the pieces of information in the argument structure with the actual information related to the computation of system’s recommendation by tapping into the different information sources [see Section 2]. With this concrete argument, WOZ generates an explanation for the recommendation. Upon the clinician’s request, WOZ can also display graphically components of the explanation, such as relevant patient data and the guideline knowledge.

4 CONCLUSIONS
ATHENA justifies its recommendations by creating explicit argument models of explanation, integrating varied information sources, and using rich visual presentations. We plan to do a formal study on usage-patterns, user-satisfaction and completeness of explanations for ATHENA.

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References