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**Segmentation of heart sound recordings by a duration dependent  
Hidden-Markov Model?**

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**Background** Digital stethoscopes offer new opportunities for computerized analysis of heart sounds. Segmentation of heart sounds into periods related to the first and second heart sound (S1 and S2) is fundamental in the analysing process. However segmentation of heart sounds recorded with handheld stethoscopes in clinical environments is often complicated by recording and background noise.

**Method** A Duration-dependent Hidden Markov Model (DHMM) is proposed for robust segmentation of heart sounds. The DHMM identifies the most likely sequence of physiological heart sounds, based on duration of the events, the amplitude of the signal envelope and a predefined model structure. The DHMM model was developed and tested with heart sounds recorded bedside with a commercially available handheld stethoscope from a population of patients referred for coronary arterioangiography.

**Results and Conclusion** The DHMM identified 890 S1 and S2 sounds out of 901 which corresponds to 98.8% (CI: 97.8-99.3%) sensitivity in 73 test- patients and misplaced 13 sounds out of 903 identified sounds which corresponds to 98.6% (CI: 97.6-99.1%) positive predictivity. These results indicate that DHMM is an appropriate model of the heart cycle and suitable for segmentation of clinically recorded heart sounds.