Aiding Clinicians through Summarization of Perinatal Data
Eric S. Hall, M.S. and Sidney N. Thornton, Ph.D., Department of Medical Informatics, University of Utah, Intermountain Health Care, Salt Lake City, UT

Exploratory analysis has focused on developing summarized views of monitor-captured perinatal data to support adherence to established clinical protocols. In addition to facilitating rapid access to significant clinical trends and reducing subjective interpretation of monitor-captured data, combining data summaries with traditional monitor review may assist in the anticipation of complications.

Background
Within the intrapartum care domain, enhanced presentation and summarization of the fetal monitor data provides an opportunity for improving patient safety and clinician workflow through the reduction of subjective clinician interpretations. While current fetal monitor devices capture important physiological characteristics including Fetal Heart Rate (FHR) and uterine contractions, they lack sophisticated decision support and the ability to integrate clinical guidelines into the data display. In addition, current monitors present data elements side-by-side, relinquishing inference and interpretation of relationships between monitored features to subjective clinician judgment.

As intrapartum care becomes increasingly guideline driven, enhanced data views will facilitate adherence to established protocols. In Anesthesiology and Cardiology, improvements to data presentation including feature extraction and graphical summarization have supported the detection, diagnosis, and treatment of relevant clinical events. Within labor and delivery, enhanced data views may likewise assist clinicians. Rather than scrubbing dozens of pages within the patient chart for important cues, graphical summaries will provide rapid “at-a-glance” access to significant trends, and together with traditional monitor review may assist in the anticipation of complications. Feature extraction may reduce variation in care delivery by reducing subjective data interpretation and enabling machineable guidelines to prompt optimal care.

Methods
Exploratory analysis of graphical properties and information processing techniques applied to digitized perinatal monitoring data has realized the development of a time-compressed summary view of synchronized FHR and uterine contraction data. Graphical dimensions considered included position, shape, color, size, and pattern. Data processing techniques included derivative, summation, and overlay, as well as smoothing and artifact handling. The features highlighted and optimized for presentation within the resultant summary view were: 1) long-term variability of the FHR and 2) occurrence, timing, and duration of FHR decelerations corresponding to uterine contractions.

Results
Figure 1 demonstrates a time-compressed summary view highlighting selected perinatal data features. The solid tracing represents FHR variability, with the level of variation at a particular time identified by the right vertical axis. The occurrence of each FHR deceleration is represented by a single dot. Vertical dot position, quantified by the left vertical axis, expresses the timing of the deceleration corresponding to a contraction. Lastly, dot size conveys the duration of the particular deceleration.

Conclusions
Variability and deceleration attributes can be extracted into a single time-compressed summarized view. As clinical usability and acceptance grows, additional features can potentially be added to the “at-a-glance” summary of the perinatal monitor data.

References