Automation of Remote Monitoring of Cardiac Implantable Electronic Devices (CIEDs): The Clinical Implications of After-Hours Data Management

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**Introduction**: Remote monitoring and follow up of data generated by CIEDs can be a complex and time-consuming process. Data flow 24 hours a day, 7 days a week and, as a result, data transmissions occur at times when devices clinics are closed. The aim of this study was to characterize after-hours transmissions by percentages of overall transmissions and by clinical urgency.

**Methods**: CIED device transmission data from patients enrolled in automated remote follow up using PaceMate™ remote monitoring software over a 12-month period were examined. Transmissions were classified as GREEN (normal), YELLOW (abnormal needing MD review) and RED (urgent action required) by PaceMate™ software and confirmed by IBHRE certified PaceMate technicians.

**Result**: There were 66,702 transmissions received from 9379 patients with 9379 devices (1 CIED per person). The transmission rate by device type ranged from 1.8 to 15.3 with a mean of 7.1 transmissions/device over the study period. Overall, 75.3% of transmissions occurred after usual business hours, 41.1% on weekday nights and 34.2% on weekends. There were 377 transmissions classified as RED alerts (0.6% of all transmissions) and 75.3% of RED alerts occurred after hours: 47.8% on weekday evening and 27.6% on weekends. There were 17,323 transmissions classified as YELLOW alerts (26.0% of all transmissions) and 75.0% of these alters occurred after hours: 48.8% on weekday evenings and 33.7% on weekends.

**Conclusion**: Three-quarters of all transmissions from remote monitoring of CIEDs occurred after hours. These data take a great deal of staff labor to process manually and may be taking time away from other important clinical activities during usual hours. Importantly, 75% of all RED and all YELLOW alert transmissions also occurred after hours. The combined total of RED and YELLOW alerts represented almost 18,000 transmission, 27% of all transmissions, and, on average, 1.9 transmissions per patient. This high volume of potentially clinically significant and actionable after-hours events puts patients at risk for missed or delayed clinical response without an automated, systematic way to process them.