

## INTRODUCTION

Kangaroo Mother Care (KMC), caring for newborns on their mother's chest 24 hours/day, has shown to be effective for thermal control, breastfeeding and bonding in newborns and was initially used in resource limited countries to reduce mortality in low birthweight infants.<sup>1</sup> For infants with a birthweight <2000g born in low- or middle-income countries, initiating KMC within the first week of postnatal life resulted in 51% reduction in mortality.<sup>1</sup> KMC has also been found to decrease health care related sepsis and improve infant growth.<sup>1</sup>

Most neonatal intensive care units are familiar with intermittent skin-to-skin care, usually short-term placement on mother's (or father's) chest, as a means to enhance breastfeeding, attachment and parental self-esteem, and studies have shown that it is safe for both non-intubated and intubated preterm infants.<sup>1,2,3</sup> However, a survey found that 59% of NICU nurse managers thought intubated infants should not receive skin to skin care for reasons including lack of criteria for infant selection, fear of extubation, stress to the infant, time involved for the nurse, temperature control, and bedside nursing fears of being blamed if something went wrong.<sup>4</sup>

The autonomic nervous system, comprised of sympathetic and parasympathetic innervations, is incomplete at birth. In premature infants sympathetic tone is dominant. Improved parasympathetic tone promotes growth and restoration in addition to energy conservation.<sup>5</sup> Heart rate variability (HRV) is the temporal variation between sequences of consecutive heart beats, measured by the normal to normal (NN interval) which is the period between adjacent QRS complexes.<sup>6</sup>

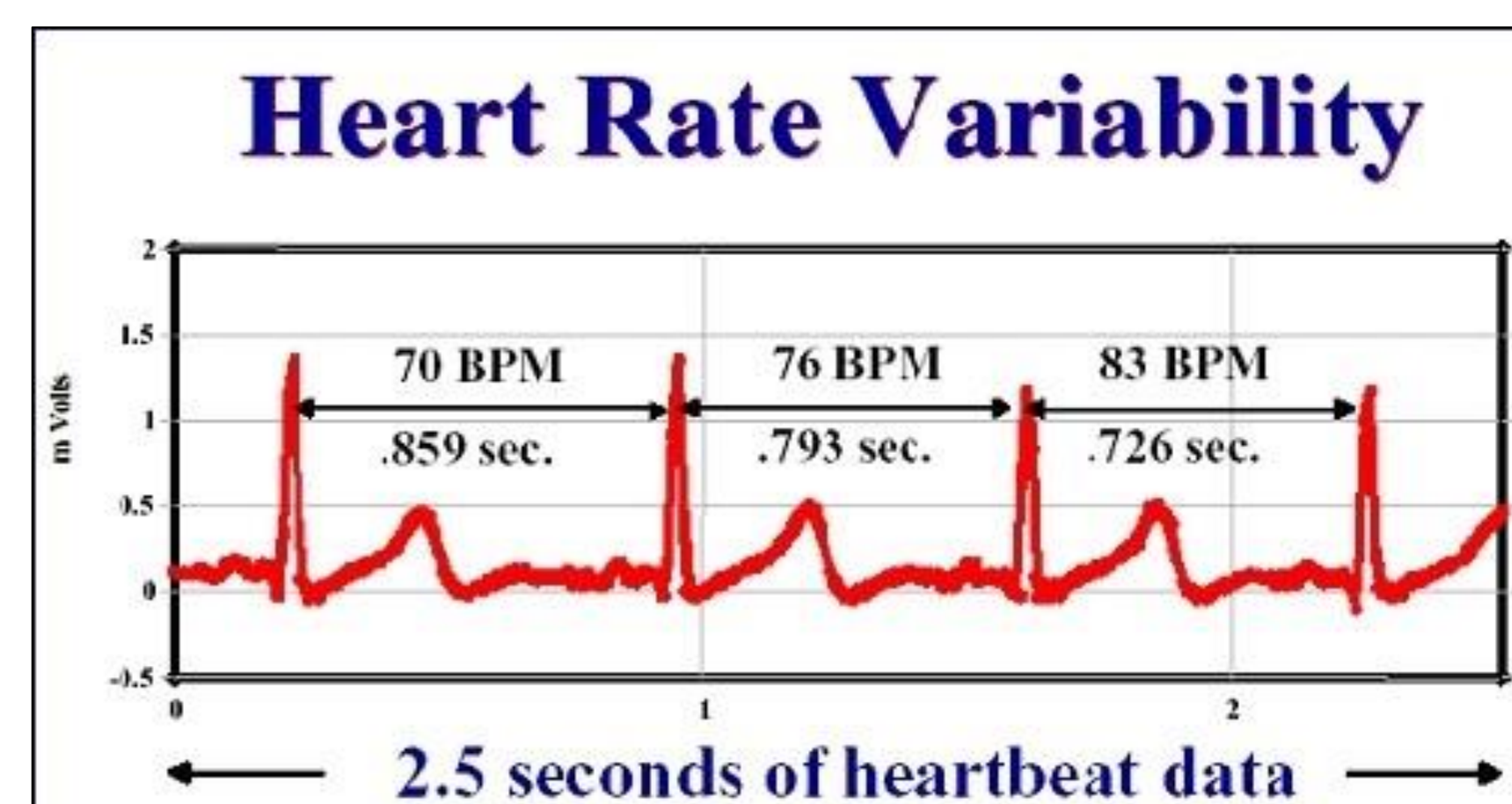


Figure 1. Heart Rate Variability Between Consecutive Heart Beats

HRV measures the balance between sympathetic and parasympathetic mediators of heart rate. HRV increases with gestational age, and lower heart rate variability reflects low parasympathetic activity in infants.<sup>7,8</sup> Studies have shown that reduced heart rate variability in a fetus, which is detectable prior to a change in normally measured heart rate, is a marker of fetal distress.<sup>9</sup> HRV measurements may be useful in capturing clinically-relevant dynamic changes in autonomic regulation in response to skin-to-skin care.<sup>8,10</sup>

## STUDY OBJECTIVE

The objective of this study is to monitor heart rate variability in preterm infants receiving respiratory support, including conventional mechanical ventilation, during skin-to-skin care.

We hypothesize that skin to skin care will be associated with a more mature pattern of parasympathetic activity as measured by various domains of heart rate variability. Specifically, the standard deviation of the normal-to-normal interval (SDNN), the root mean squared of successive differences of normal-to-normal intervals (RMSDD), and the standard deviation of deceleration (SDDec) will decrease in infants that are receiving skin-to-skin care across all types of respiratory support, compared to infants lying in their isolette.

In addition to the objectives presented above, an exploratory aim will evaluate the differences in heart rate variability of preterm infants between mothers and fathers performing skin-to-skin care. The study will collect the gender of the parent performing skin to skin with the infant for each session.

## METHODS

### Selection of Patients (goal n=10):

The inclusion criteria include:

- 1)  $\leq 30$  weeks gestational age at birth
- 2) < 6 weeks postnatal age
- 3) No severe intraventricular hemorrhage on cranial ultrasound (Grade III or IV)
- 4) Receiving respiratory support at the time of the first session:
  - Conventional mechanical ventilation
  - Noninvasive positive pressure ventilation (NIPPV)
  - Continuous positive airway pressure (CPAP)
  - High flow nasal cannula (HFNC)
  - Low flow nasal cannula (LFNC)

Exclusion criteria include:

- 1) Known genetic disorders or prenatal chromosomal anomalies
- 2) Major congenital anomaly
- 3) Undergoing active sepsis evaluation or treatment for infection
- 4) Receiving blood pressure or cardiac medications or infusions including inotropic medications
- 5) Mother <18 years old, incarcerated, requiring a legal representative, or non-English speaking

Three HRV sensors and a pneumogram are placed on the infant's chest in the isolette. Heart rate variability data are collected for 30 minutes, after which the infant is placed skin to skin with a parent and HRV data collected for another 30 minutes. Following the completion of skin to skin, the infant is placed back in bed and HRV data are collected for a final 30 minutes. HRV sensors and the pneumogram are removed following data collection completion, using massage oil to reduce skin irritation.

## CURRENT PROGRESS

Participant enrollment, data collection and statistical analysis are currently ongoing. Thus far, 8 infants have been enrolled.

Figure 2. HRV Data collection

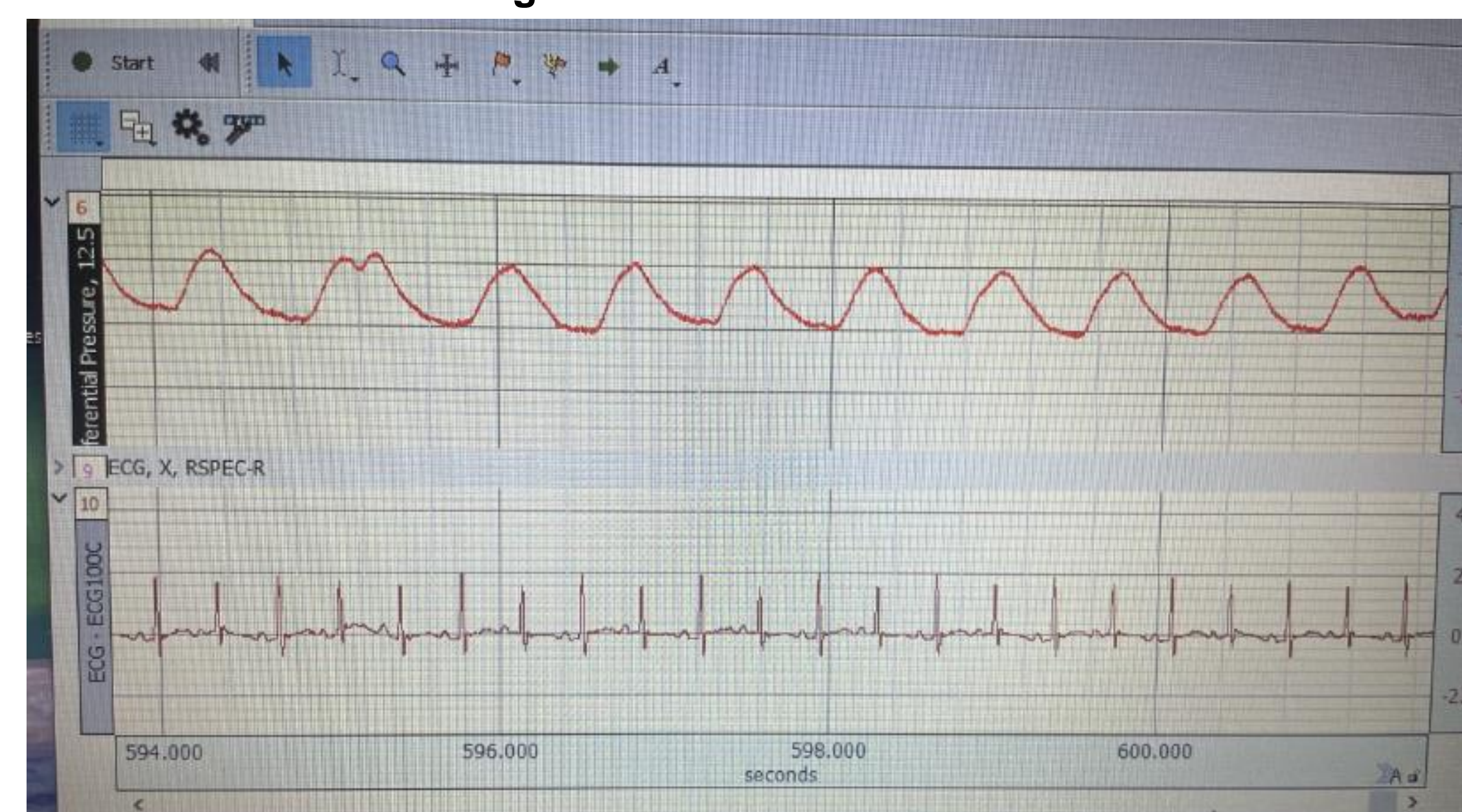


Figure 2: The upper line shows the pneumogram tracing, with the lower line reflecting the heart rate.

Figure 3. HRV preliminary data analysis

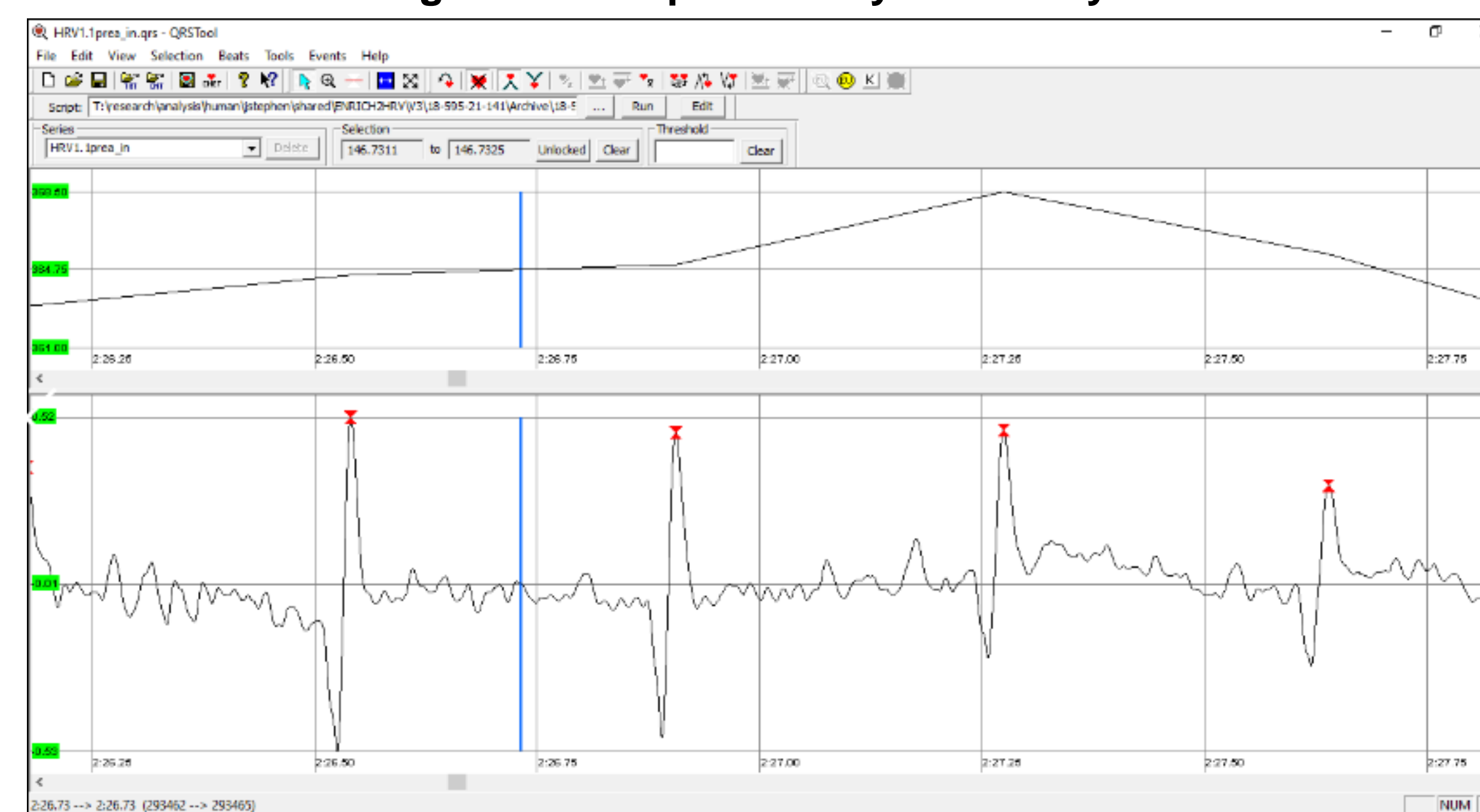


Figure 3: Initial data cleaning of the HRV to minimize inclusion of non-accurate QRS complexes.

## DISCUSSION

While sympathetic tone is dominant in premature infants, we know that parasympathetic tone promotes growth and restoration in addition to energy conservation. Heart rate variability measures the balance between sympathetic and parasympathetic mediators of heart rate.<sup>5</sup> HRV increases with gestational age and has been shown to increase with skin to skin care.<sup>7,8,10</sup> With studies showing skin to skin care is safe for preterm infants, even while intubated, the opportunity exists for more infants to be held skin to skin with their parents.

There are limited studies looking at HRV in preterm infants requiring respiratory support, including intubation, though one observed HRV in 191 skin to skin sessions in 11 preterm infants that resulted in a statistically significant difference in six of the 8 HRV monitored.<sup>10</sup> Given the limited research in this area, we hope our study will provide more information on the effects of skin to skin on heart rate variability in preterm infants.

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