

# Using Parameter Estimation for Mathematical Model Predicting Pediatric SCD Pain

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## Abstract

Sickle Cell Disease (SCD) is a family of genetic blood disorders that affects over 20 million people worldwide, whose prevalent complication is pain. Pain crises in SCD are strongly linked to mortality and morbidity, and increased medical costs. During childhood, SCD often presents as severe, acute pain episodes characterized by unanticipated pain periods ranging from hours to weeks, usually occurring a few times a year. The study in Valrie et al. [2019] revealed a correlation between sleep and pain using actigraphy and patient reported sleep quality and pain in 88 pediatric SCD patients. Our mathematical model builds on the modeling idea of Clifton et al. [2017]’s predictive model which used disease predictors and e-diary data from adult SCD patients. Our model modifications reflect that sickle cell pain in childhood presents differently, without chronic pain, and that poor sleep quality is correlated with increased SCD pain. Our initial model captures some components of the patient data, but indicates further model refinement is needed. We plan to refine the model using cumulating data effects, adding patient data factors, and/or incorporating additional model components. Previous studies support that poor sleep correlates with increased SCD pain severity the next day [Valrie et al., 2019], thus we anticipate our predictive model to encapsulate pediatric pain episode onset using patient actigraphy and diary data. Our hope is to develop a warning system for upcoming pain events for pediatric SCD patients.

## References

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