Night Team Scheduling for Pediatric Inpatient Residents
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Problem Statement
The pediatric rotation at Michigan Medicine requires residents to work certain night shifts every month. These “Night Team” residents cover the inpatient units (General, PICU, NICU, etc.) from 7pm to 7am on nights they are assigned.

Research Objective: Develop a decision support system to enable fast construction of high-quality pediatric “Night Team” schedules while improving measures of quality.

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<tr>
<th>Class</th>
<th>Name</th>
<th>Program</th>
<th>Start Date</th>
<th>End Date</th>
<th>LB Shifts</th>
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Traditionally, chief residents construct the pediatric “Night Team” schedule by hand, a process that is resource-intensive yet often fails to satisfy the individual and collective needs of stakeholders.

Objective Function
\[
\min \sum_{s \in S} \left( w_{s1} x_{s1} + w_{s2} x_{s2} + \sum_{d \in D} w_d x_{sd} \right) + \sum_{d \in D} w_d x_{sd} \\
\]

Activity Limits
\[
\sum_{d \in D} x_{sd} = 1 \quad \forall r \in R \quad \forall d \in D
\]

Coverage Requirements
\[
\sum_{r \in R} x_{rd} = a_r \quad \forall d \in D
\]

Minimum Work Sequences
\[
x_{rd} \leq x_{rd+1} \quad \forall r \in R \quad d \in \{1, \ldots, |D| - 2\}
\]

Maximum Work Sequences
\[
x_{rd} \geq M_{rd} \quad \forall r \in R \quad d \in \{D - M_{rd} - 2\}
\]

Emergency Medicine Conferences
\[
x_{rw} \geq 1 \quad \forall r \in R \quad w \in W
\]

Preferred Duration of Work Sequences
\[
f_{rd} + m w_{rd} - 1 \geq f_{rd+1} + m w_{rd+1} - 1 \quad \forall r \in R \\
\]

Preferred Shift Equality
\[
\sum_{d \in D} \chi_d x_{sd} = \chi_d x_{sd+1} \quad \forall r \in R \\
\]

Variable Restrictions
\[
\chi_d(0,1), \chi_{sd}(0,1), x_{sd}(0,1), \chi_d \geq 0
\]

Impact/Results
Stakeholders reported improved satisfaction for:
- Limiting number of consecutive 2- and 6-day work sequences
- Satisfying vacation requests
- Enabling Emergency Medicine conference participation
- Ensuring schedule fairness

Future Work
Encode the tool in C++ using CPLEX to supplement ease of use

Ease of Use
Inquire residents on additional areas of improvement in schedule

Satisfaction
Expand the model to determine which dates are best to have 3 seniors + 0 interns vs 2 seniors + 2 interns

Quality

Acknowledgements
We graciously thank the following organizations for their support: