How can we produce higher-quality schedules in less time while satisfying the various educational and personal requirements of residents?

**Problem Statement**

The Dermatology Residency Program at the University of Michigan requires each resident to be assigned to two specific activities each weekday, one in the morning and one in the afternoon, within a month-long planning horizon. Each activity must meet staffing requirements, and the residents must adhere to educational requirements.

**Traditional Approach**

Chief residents typically create monthly schedules by hand. Due to the numerous rules chiefs must abide by, the process of building a feasible schedule typically requires numerous hours to complete, and building a high-quality schedule by hand is nearly impossible.

**Feasible Schedule**

A valid schedule that meets all of the hard requirements presented by the Dermatology chief residents.

**High-Quality Schedule**

A schedule requiring a minimal number of undesirable characteristics, such as intra-day travel and shortages of administrative time.

**Challenges**

- Chief residents spend valuable time creating schedules rather than focusing on patient care.
- Residents are given insufficient administrative time to balance their clinical duties.
- Residents are often required to travel between clinical sites, which wastes time finding parking, and can cause missing lunch.

**Research Goals**

- Work with chief residents to determine the scheduling rules and quality metrics.
- Formulate a mathematical model, and build a computerized tool which rapidly generates high-quality schedules.

**Solution Approach**

- Formulate mathematical model
- Encode in C++ using CPLEX
- Load monthly input files
- Solve for a high quality schedule
- Review schedule and metrics

**Decisions**

- Do we assign resident \( r \) to activity \( a \) on date \( d \) during shift types?

**Rules**

All of the rules, modeled as constraints, must be satisfied for a schedule to be feasible.

**Clinic Staffing Requirements**

- \( \sum_{s \in S} x_{rads} \leq 1 \quad \forall r \in R, d \in D, s \in S \)

**Clinic Staffing Requirements**

- \( l(c) - v^c_a \leq \sum_{r \in R} x_{r(c)d(c);c(s)} \leq u(c) + v^c_a \quad \forall c \in C \)

**Implementation**

Implementation of the computerized tool has allowed for schedules to be produced in significantly less time while satisfying all schedule requirements and improving schedule quality across several metrics.

**Acknowledgements**

We thank the University of Michigan Department of Dermatology, the work of former CHEPS research students, and the following organizations for sponsoring this work: