Case Study

MEDECIPHER

Applying operational intelligence to reimagine nurse staffing models

AT A GLANCE

Powerful machine learning and prescriptive analytics technology with proven results in matching nurse schedules to patient demand, reducing costs, balancing clinical and operational goals, enforcing rules, improving personalization, and expediting the scheduling process.

COSTS ↓8% SAFETY ↑68% RULES ✓100% PERSONALIZATION ✓100% TIME ↓77%

OVERVIEW

The nursing workforce has been deeply disrupted due to a worsening nursing shortage, deteriorating ability to forecast needs, and the rise of a gig economy. Nurse leaders require tools to design, evaluate, and implement customized and flexible nurse staffing models that adapt to the changing labor landscape.

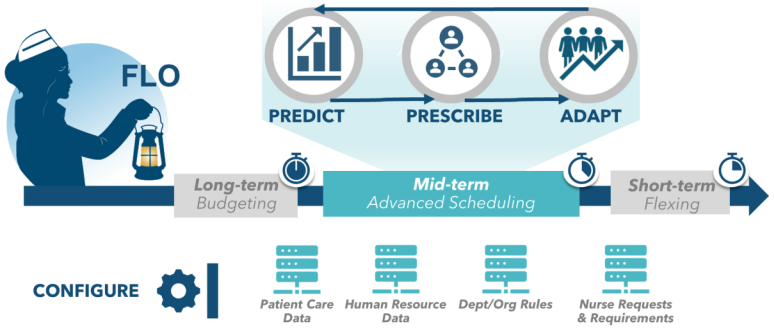
SOLUTION

Medecipher's decision support tool, FLO, enhances current scheduling tools by combining predictive and optimization technologies to make better use of available resources and data. FLO helps nurse leaders design, evaluate, and implement customized staffing models that align the competencies and preferences of an individual nurse to the patient care needs of the healthcare system.

FLO works in concert with legacy scheduling tools supporting various stages of the decision making horizon with a focus on advanced scheduling.

Based on an institution's site-specific data, FLO's more accurate patient demand forecasting utilizes advanced machine learning models to achieve optimal staffing levels. The resulting recommended nurse schedule maximizes financial and clinical organizational goals while taking into consideration:

- Nurse leader controlled decisions
- Regulations & labor rules
- Nurse preferences



RESULTS

A recent retrospective staffing model analysis at a Level I Trauma Center within a community hospital compared the actual nurse schedule for a selected scheduling block against FLO's mathematical algorithm solution across five dimensions: cost, patient safety, rule adherence, planning time, and personalization. Overall, FLO's solution found a superior nurse schedule.

STUDY PARAMETERS

FACILITY: 28-bed Emergency Department (ED) with 60,000 annual visits *(approximately)*

TIME FRAME: 4-week scheduling block

SCHEDULING HORIZON: 4-weeks in advance

DATA: Historical ED hourly patient census ▪ Nurse employee roster ▪ Department and organization rules ▪ Collective bargaining agreement (CBA) policies governing the rules of nurse labor within the ED ▪ Nurse shift preferences

COSTS ▼ 8%

Labor costs were reduced by 8%, resulting in a **$636,836** annualized savings in avoidable costs.

COSTS			
Base Costs	$478,920	$478,920	-
Overscheduling - RT Pay (surplus) *Total surplus hours x cost*	$55,637	$43,711	$11,926 savings
Under-scheduling - OT Pay (shortfall) *Total shortfall hours x cost*	$36,802	$12,041	$24,761 savings
Unfilled Shifts - OT Pay *Total unfilled hours x cost; 150 hours/schedule*	$6,900 (150 hrs)	$0	$6,900 savings
Total Labor Cost for Block	$578,259	$534,672	$43,587 savings
			Annualized Savings* of $636,836

* 13 blocks/year, including cost reduction savings of .43 FTE in schedule planning time.

SAFETY ▲ 68%

Safety outcomes were increased by 68%, with an improvement in average understaffing.

SAFETY			
Minimum Staffing *Min. nurses at each hour (includes lunch coverage)*	Direct: 4 Indirect: 2	Direct: 4 Indirect: 2	0 (neutral)
Understaffing (hourly max) *Nurse demand less scheduled direct nurses*	Frequency: 33% Max/hour: 6 Avg/hour: 0.53	Frequency: 23% Max/hour: 2 Avg/hour: 0.17	Frequency: 10% points Max/hour: 4 Avg/hour: 0.36 (68%)
Unsafe Staffing *% of time that patient-to-nurse ratio exceeds 4-to-1*	6%	1%	5% points
Optimal Staffing *% of time that patient-to-nurse ratio between 2-to-1 and 4-to-1*	84%	94%	10% points
Max Ratio *Max patient-to-nurse ratio*	6.0 : 1	4.5 : 1	1.5 : 1
Consecutive Shift Violations	# RNs working > 5 consecutive days	0	-

RULES ▲ 100%

Adhered to 100% of all Department and Organization labor policies and rules.

RULES			
Nurse Eligibility *Nurses assigned only to shifts for which eligible to work*	n/a *	100% honored	
Safety *Min nurses, max patient/nurse ratio met per hour*	n/a *	100% honored	
Charge & Triage *Minimum Charge and Triage nurse coverage met per hour*	n/a *	100% honored	
Nurse Shift Preferences *Shifts (preferred and avoided) met per day*	n/a *	100% honored	
Nurse Utilization *Avg. Total utilization – Productive + Unproductive*	FT: 0.9 FTE PT: 0.6 FTE PTQs: 0.5 FTE Casual: < 0.1 FTE	FT: 0.88 FTE PT: 0.58 FTE PTQ: 0.55 FTE Casual: 0.1 FTE	

* Data was not available due to confidential nature or was not tracked/retained electronically by the department.

PERSONALIZATION ▲ 100%

Honored 100% of required RTO, PTO and training requests, and 83% of optional nurse preferences.

PERSONALIZATION			
# of Requested Time Off (RTO) * *when they don't want to work* **GOAL:** minimum of 2 RTOs/shift X RTOs/block	2 RTOs/block	≥ 2 RTOs/block 100%	
Preferences met * *when they want to work (day and shift)*	n/a **	83% overall (total); D - ~85% E -~80% N - ~80%	
PTO, Training * *Schedule honors pre-scheduled PTO & Training; % of non-clinical hours in the schedule*	100% honored; 18%	100% honored; 17.5%	

* for the top 10 most senior RNs

** Data was not available due to confidential nature or was not tracked/retained electronically by the department.

TIME ▼ 77%

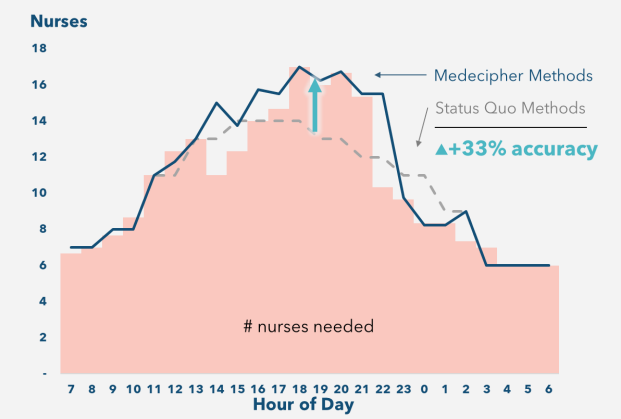
Time required for schedule planning was reduced by 77%, resulting in a reduction of **0.43 FTE** from the current manual process that governs nurse scheduling today.

TIME			
Initial setup	n/a	10 hours/year	10 hours /year
Monthly planning	20 hours/block	6 hours/block	14 hours /block
Daily maintenance	*2.5 hours/day* 70 hours/block	*0.5 hours/day* 14 hours/block	56 hours /block
	90 hours/block =1170 hours/year	20 hours/block + 10 =270 hours/year	70 hours / block - 10 = 900 hours/year
	0.56 FTE	0.13 FTE	= 0.43 FTE
			77% reduction

PREDICTIVE FORECASTING

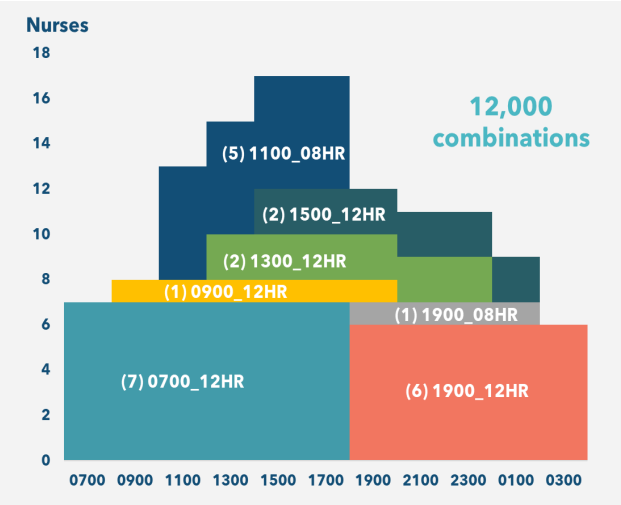
FLO leverages the latest predictive modeling techniques to forecast patient volume demand and predict true nursing workloads based on an institution's site-specific data.

FLO PREDICTS TRUE NURSING WORKLOADS



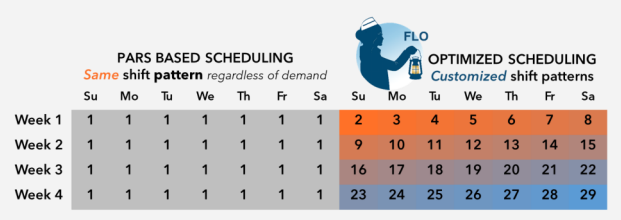
Shifts are then aligned to the workloads to provide the optimal amount of nurses needed at every hour.

FLO ALIGNS SHIFTS TO WORKLOADS

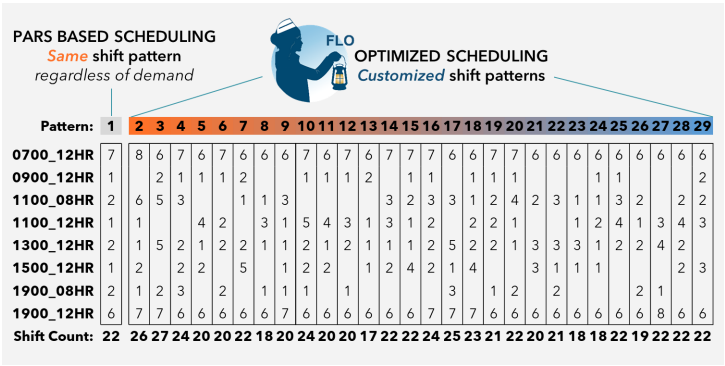


Through optimized scheduling, multiple shift patterns are created which enable more flexibility and better align the coverage model between nurse supply and patient demand.

FLO PRESCRIBES NURSE SHIFTS TO MEET DEMAND



FLO OPTIMIZES SCHEDULING



OPTIMIZATION MODELING

FLO's mathematical optimization model optimizes the nurse staffing schedule for the block by assigning each nurse to a specific shift.

The model takes into consideration:

- Nurse shift eligibility
- Nurse time availability
- Safety and quality of care requirements
- ED, organizational, and CBA labor policies
- Nurse preferences

The result is a feasible schedule that minimizes total labor costs while maximizing requested shift and RTO nurse preferences.

MODEL COMPLEXITY

*Highly complex with approximately **1.2 million constraints** and **3.5 million decision variables**. **Solved in approximately 5 minutes** using sophisticated mathematical solver software.*

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