BrandDataLab

AI/ML Driven

Hospitalist and Nurse Scheduling for Healthcare Industry

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Executive Summary

Healthcare delivery in the US is transforming even more rapidly post-COVID.
According to McKinsey Insights [4], “If the healthcare delivery industry could rely more heavily on labor productivity gains rather than workforce expansion to meet demand growth, by 2028 healthcare spending could potentially be about $280 billion to $550 billion less than current national health expenditure (NHE) projections suggest.“

BDL’s AI based technology customized for healthcare applications (such as hospitalist scheduling and nurse scheduling) can significantly reduce the time, op-ex and the drudgery involved, while it also enables several new possibilities not offered by conventional solutions. BDL solution typically results in improved job satisfaction and less stress for the healthcare staff, because of the various tactical, strategic as well as human parameters it optimizes.

Defining the Problem

Why is there a nursing shortage?

"The nursing shortage is a complex problem with several causes. There are many factors at play, from a larger-than-ever population of older adults to nursing burnout. The combination of these factors is driving the nursing shortage and causing it to grow over time.

The growing population of older adults The generation born between 1946 and 1964, known as baby boomers, is one of the largest in American history. About 21 percent of current American adults are baby boomers. There will be a projected 71 million Americans age 65 or older by 2029.

Age-related conditions lead to a significant rise in the need for healthcare services. In fact, the Centers for Disease Control and Prevention (CDC)Trusted Source reports that over half of Americans over age 65 have two or more chronic health conditions. Plus, with advances in healthcare and movements to improve healthcare access, the baby boomer generation will likely have a longer lifespan than previous generations.

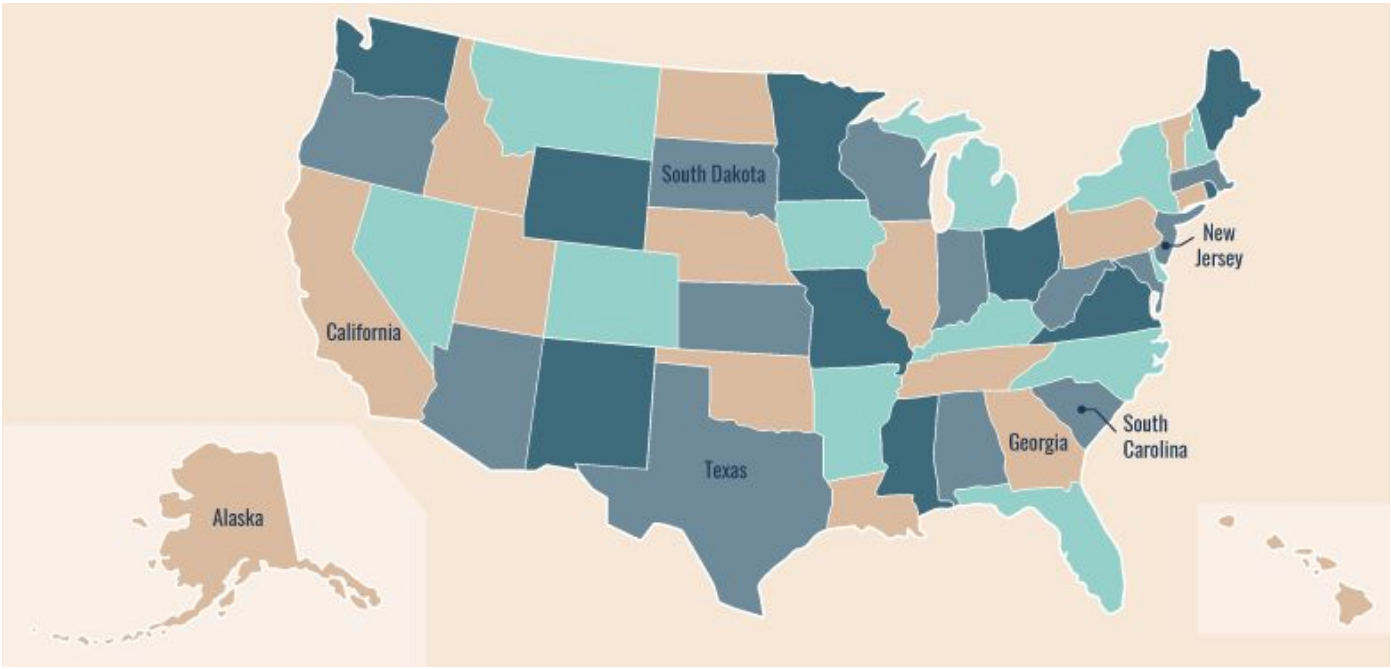
Challenges

1. Nurse burnout
Burnout is both a cause and symptom of the nursing shortage. Understaffed nursing units increase the pressure and stress on nurses. The mental and physical toll of this pressure can quickly lead to burnout

2. Longer wait times for care
Patients have to wait longer when healthcare facilities don't have the nursing staff they need. When seeing more patients, nurses are often rushed and stressed. That can lower patient satisfaction and negatively affect patient outcomes.

3. Medication errors and fatalities
Patient care and safety are improved when there's an appropriate number of nurses on staff. Errors in medication and other care delivery are more likely when facilities are understaffed. These errors can have serious consequences (8)."

Defining the Problem



Which states are in the greatest need?

"There is a need for nurses across the country, but certain areas face a much greater shortage than others. The southern and western portions of the nation are expected to face some of the largest needs for nurses.

The United States Department of Health and Human Services predicts that these states will have the greatest need for nurses by 2030 (in order of greatest need) :

- California
- Texas
- New Jersey
- South Carolina
- Alaska
- Georgia
- South Dakota

California alone is projected to need about 44,500 new RNs by 2030 (8)."

Key Opportunities

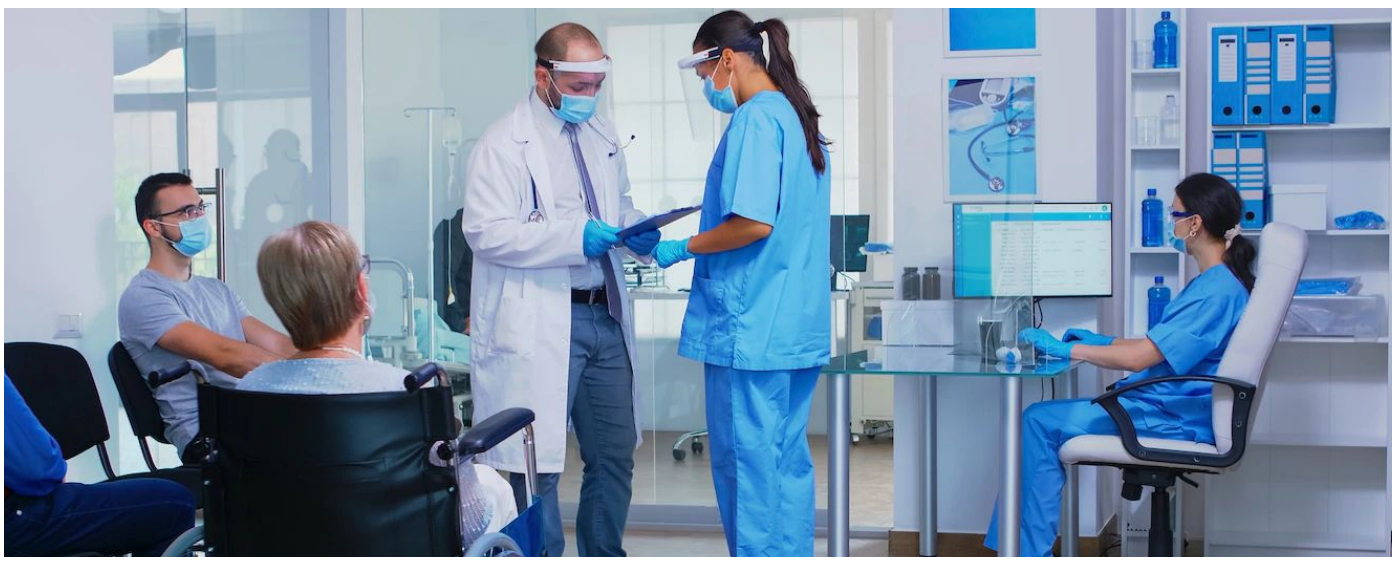
The current ways of **hospitalist scheduling** must be improved—helping to reduce burnout and improve patient care [5]. Even prior to COVID pandemic, about a third of the hospitalists were dissatisfied with the scheduling [6] which has become a much worse problem post-pandemic, as there is an urgent need to allow for a lot of flexibility and accommodation of various constraints in hospitalist scheduling that were previously unimportant (e.g. location, time and team preference, fast re-scheduling in case of unforeseen changes). There is a need to allow for a much more flexible work scheduling other than the traditional 7-ON/7-OFF 12 hour shifts. The hospitalists may have different target hours, different specialties and sites in case of a multi-site hospital group, requirement that no two consecutive working weekends, different work hours, flexible and fair time-off policy etc.

The **nurse scheduling problem** involves the assignment of shifts and holidays to nurses. The problem is described as finding a schedule that both respects the constraints of the nurses and fulfills the objectives of the hospital. [7] Conventionally, a nurse can work 3 shifts (day, night, late night).

Nurse scheduling at hospitals must account for the following constraints, and some more:

- Typically, a nurse cannot be assigned to multiple shifts on the same day.
- Flexible PTO (Paid Time Off) must be accounted for while scheduling nurses in any department of a hospital.
- A nurse should not be assigned a late night shift followed by a day shift the next day.
- Nurses may request preferred co-workers based on skills or other parameters.
- A certain number of nurses must be guaranteed to be assigned at certain departments at all times.
- A shift requires a charge nurse.
- Differences in qualifications between nurses also create hard constraints
- Fairness in allocation of shifts for nurses
- Op-ex optimization for the hospital

In case of both hospitalist and nurse scheduling problems, the BDL solution optimizer considers up to 25 of such constraints, and results in a drudgery-free scheduling experience, resulting in significant time-savings and opex-savings for the hospital.



Predictive and Resilient Scheduling of Hospitalists

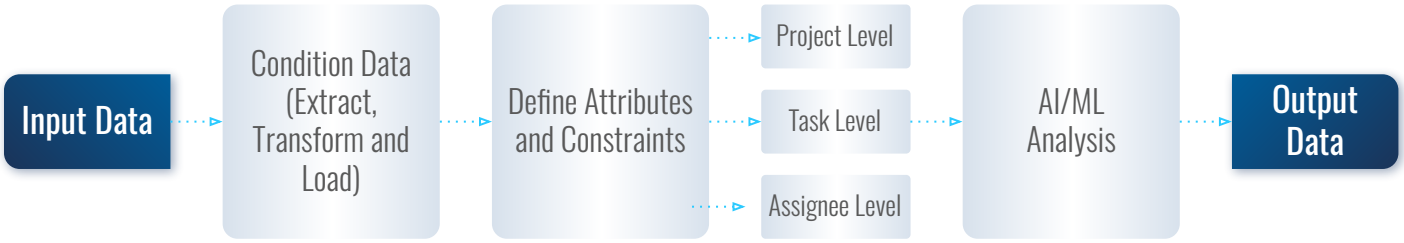
BDL's AI engine efficiently navigates through all the constraints and finds a near-optimal allocation of work to the staff, that accounts for human preferences as well as total cost and time. What differentiates the BDL solution is that it simultaneously optimizes total time and opex across the entire team, across an arbitrary set of tasks. It is designed to be extremely efficient in terms of supporting analysis of various hypothetical "what-if" scenarios, in order to cover incumbency plans and their associated op-ex, given the post-Covid unpredictability in terms of staff availability.

Basic Architecture / Plan and Pathways

BDL's AI based solution differentiates itself along many dimensions from other options in the marketplace, for example, by treating strategic aspects of schedule optimization differently from tactical aspects. It differentiates between various levels of urgency and importance associated with any task, and the AI engine schedules important tasks before they become urgent. It accounts for human preferences for tasks, human preferences for locations and flexible hours/shifts, human preferences for co-workers and tasks, prerequisites and post-requisites of tasks, fixed-ETA versus flexible-ETA tasks, avoiding priority inversion, all while maximizing the efficiency and minimizing the op-ex simultaneously. It can model perturbations caused by outside factors, and can assess cost and schedule impact in various "what-if" scenarios, thus enabling emergency preparedness and avoiding future drudgery.

In a typical hospitalist schedule optimisation, the BDL AI solution results in approximately 20% cost and time saving across weekly, monthly, quarterly or even annual schedules.

Basic Architecture



The above block diagram gives a high-level overview of the scheduling tool. The user provides project information and runs the AI/ML engine. In under 5 seconds the AI/ML engine runs proprietary algorithms and gives a customized schedule for each participant after taking into account all the specified preferences and constraints. The steps are as follows

1.) Input Data

- Project information (Names, locations, co-workers, permitted work schedule etc.)
- Preferences (working weekdays / weekends, work times, co-workers, holidays etc.)
- Constraints (locations, co-workers, consecutive weekends etc.)

2.) Condition Data

- Extract the desired information from the above input data
- Transform this data in a format compatible with the tool and
- Load it in the Ai/ML engine

3.) Attributes and Constraints

- Specify following attributes:
  a.) Project level (duration, workforce etc.)
  b.) Task level (work hours, holidays etc.) and
  c.) Assignee level (preferences, constraints etc.)

4.) AI/ML Engine

- Execute the AI/ML algorithms and generate the output

5.) Output Data

- The output report is a detailed schedule for each participant consisting of preferences, constraints and cost functions

What can BDL do for you?

BDL is a boutique firm that helps clients with data extraction, integration and AI/ML analysis. BDL solution for AI/ML driven predictive scheduling and workload management, has generated upto 20% savings in OpEx for clients.

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22 years experience as a medical innovator combining operational expertise, clinical proficiency & strategic acumen. Currently is the Chair of the Mayo Clinic Department of Laboratory Medicine & Pathology, & President of Mayo Clinic Laboratories. Maintained oversight of 8 divisions, 60+ testing labs, 190+ physician-scientist staff, and 3000 allied health staff.

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