## **1) Deeper Facility-Level Investigation**

**Goal**: Explain why some facilities use fewer contract CNAs when census spikes, and confirm whether others show the opposite pattern (i.e., more contract CNAs on busier days).

1. **Identify Inverting Facilities**
   * Compute the daily correlation between cna\_temp\_ratio and mdscensus for each facility.
   * Focus on those with strong **negative** correlations (e.g., < -0.5) to see why they reduce contract usage on high-census days.
   * Validate for stable or missing census data (which can lead to NaN correlations).
2. **Examine Schedules & Policies**
   * Facilities that “invert” may be better at scheduling employees to handle higher loads. Confirm by reviewing their total employee vs. contract hours on busy days.
3. **Deliverables**
   * A short list of high-census “inverter” facilities with daily usage plots.
   * A summary of the data quality checks for stable/missing census.

## **2) Hourly or Shift-Level Data**

**Goal**: Determine whether morning/evening/overnight shifts see distinct patterns of contract CNA usage.

1. **Shift Slicing**
   * If your data includes timestamps for hours, classify them into 3 or 4 shift blocks (e.g., Day 7am–3pm, Evening 3pm–11pm, Night 11pm–7am).
   * Recompute cna\_temp\_ratio by shift.
2. **Compare Variation**
   * Does the ratio spike during overnight hours (when staff may be harder to come by)?
   * Are weekend nights especially reliant on contract CNAs?
3. **Deliverables**
   * Shift‐level line or box plots, highlighting high or low contract usage windows.
   * Correlation or aggregator to see if certain shifts consistently rely more heavily on contracts.

## **3) Integrate Cost & Quality Metrics**

**Goal**: Link daily or weekly high contract CNA usage to financial and quality outcomes.

1. **Cost Data Merge**
   * Incorporate **overtime expenses**, **agency fees**, or other cost fields by facility and date.
   * Check if higher contract ratio days/weeks coincide with cost surges.
2. **Quality Indicators**
   * Merge with **resident complaints**, **staff turnover**, **survey deficiency scores**, or star ratings.
   * Investigate whether frequent or high contract usage correlates with lower resident satisfaction or more penalties.
3. **Deliverables**
   * Scatter plots or time‐series overlays (contract ratio vs. cost metrics).
   * Basic correlation/regression results linking contract usage to cost/quality dimensions.

## **4) Review Weekend Policies**

**Goal**: Address the observed weekend spikes in CNA contract ratio.

1. **Weekend Ratio Analysis**
   * Quantify how much higher the ratio is on weekends vs. weekdays, both in aggregate and for specific facilities.
   * Confirm whether “high census, low ratio” still applies on weekends or flips.
2. **Staffing Policy Recommendations**
   * If the ratio is significantly elevated on weekends, explore **shift differentials** or **incentives** for employee CNAs to pick up weekend shifts.
   * Possibly run a cost-benefit analysis to see if compensating employees on weekends is cheaper than paying contract staff.
3. **Deliverables**
   * A weekend/weekday comparison chart (e.g., bar chart of mean daily ratio).
   * Policy suggestions or hypothetical cost scenarios showing whether weekend staff incentives reduce contract spending.

## **5) Segmentation by State or Ownership**

**Goal**: Determine if state regulations, local labor markets, or facility ownership types affect contract CNA usage patterns.

1. **Group by State**
   * Evaluate average or median CNA ratio, total contract hours, or outlier frequency.
   * Consider local laws or union presence that might shape staffing approaches.
2. **Group by Ownership**
   * For-profit vs. nonprofit; chain vs. independent.
   * Check if certain ownership structures rely more on contract staff.
3. **Deliverables**
   * Bar charts or maps showing variation across states and ownership categories.
   * Conclusions about local labor/legal conditions that might drive weekend or high/low ratio patterns.

## **6) Explain Daily CNA Ratio Oscillations**

**Goal**: Interpret the daily ratio’s observed up-and-down pattern, especially on days with higher average resident census.

1. **Day-to-Day Variation**
   * Confirm that “on higher average days, contract CNA usage is actually lower.”
   * Possibly, employees cover the extra load while contract usage stays constant or even dips.
2. **Facility‐Level Checks**
   * Some facilities might show the opposite trend, using more contract staff when census is high. Summarize how many facilities do so.
3. **Deliverables**
   * A short analysis or example case where the ratio dips precisely on peak census days.
   * Hypotheses explaining how or why certain facilities prefer internal staff in busier periods.

## **Putting It All Together: Actionable Next Steps**

1. **Drill Deeper into Facility-Level & Shift-Level**
   * Identify how many facilities reduce contract usage when census spikes, or if some remain the opposite.
   * Distinguish weekend vs. weekday, and see if shift-level data clarifies coverage gaps.
2. **Merge Cost & Quality Data**
   * Evaluate whether weekend contract usage or heavy day-to-day reliance leads to higher costs or negative resident outcomes.
3. **Form Policy & Operational Recommendations**
   * If weekend usage is notably higher, propose weekend wage differentials or shift swapping.
   * If certain states or ownership types show consistent patterns, tailor your strategies accordingly.
4. **Iterate**
   * Continue refining your approach as new data (like shift-level times or cost metrics) becomes available, ensuring your analysis addresses both the big picture (weekly/monthly usage) and the finer details (facility-level or shift-level patterns).

### **Conclusion**

By following these **six major steps**—deep dives at the facility level, shift-level breakdown, cost/quality data integration, weekend policy review, segmentation, and clarifying the daily ratio oscillations—you’ll gain a **robust, multi‐dimensional understanding** of CNA temporary staffing usage. This not only reveals *how* and *why* contract CNA hours fluctuate but also drives **practical interventions** (policy changes, cost strategies, or targeted marketing angles) to optimize coverage and reduce reliance on high-cost contract staffing, especially on weekends and in high-census scenarios.