PROJECT REPORT

Data Modeling Approach

To support accurate aggregation and analysis of ICU and SICU bed capacity, the dataset was structured using a dimensional (star schema) model. This ensured that measurable bed counts were analyzed at the correct level of granularity: **hospital × bed type**.

Dimension Tables

Two dimension tables were identified to provide descriptive context for the measurable data.

Bed Type Dimension (`bed_type`)
This table defines the classification of hospital bed categories.

- ***bed_id*** – Primary Key
  Uniquely identifies each bed type.
- ***bed_code*** – Categorical identifier for the bed type (e.g., ***ICU***, SICU).
- ***bed_desc*** – Descriptive label providing additional context.

All fields in this table are descriptive attributes. There are no measurable values; therefore, the table functions purely as a dimension.

Hospital Dimension (`business`)
This table represents healthcare facilities within the network.

- ***ims_org_id*** – Primary Key
  Uniquely identifies each hospital or organization.
- ***business_name*** – Hospital name used for reporting and grouping.

These fields describe hospital-level attributes and do not contain measurable data. As such, this table serves as a dimension in the analytical model.

Fact Table

- The ***bed_fact*** table contains the measurable values used in the analysis. These variables represent quantifiable bed capacity and utilization at the intersection of hospital and bed type.

Fact Variables

- ***license_beds*** – Number of beds a hospital is licensed to operate.

- ***census_beds*** – Number of beds currently occupied, reflecting patient utilization.
- ***staffed_beds*** – Number of beds that are actively staffed and operational.

These measures are numeric, additive, and central to evaluating ICU and SICU capacity.

Foreign Keys within the Fact Table

Although stored in the fact table, the following fields function as dimensions:

- ***ims_org_id*** – Links each record to the hospital dimension.
- bed_id – Links each record to the bed type dimension.

Model Summary

The resulting structure follows a classic star schema:

- One central fact table (***bed_fact***)

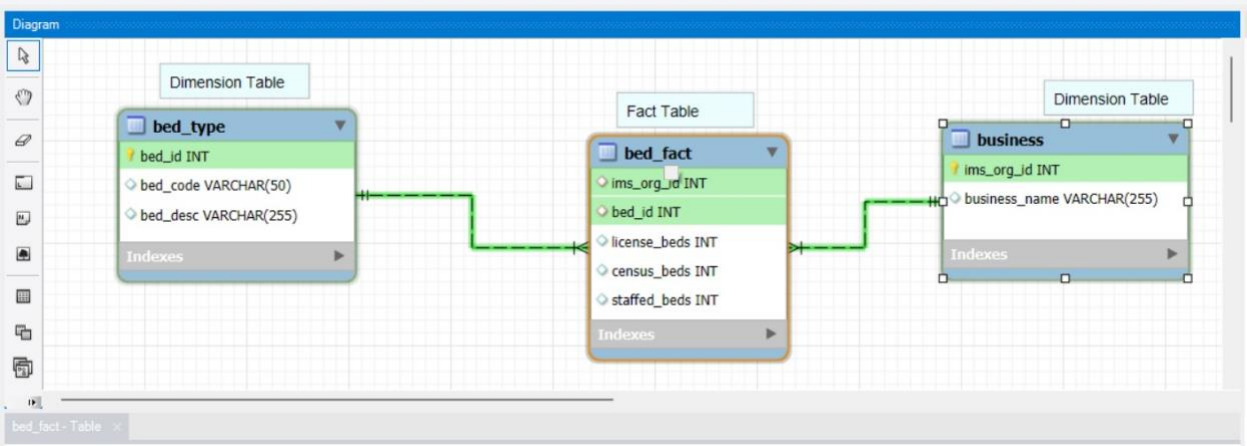
- Two supporting dimension tables (***business, bed_type)***
- Analysis performed at the grain of hospital and bed type

This modeling approach ensures:

- Accurate aggregation of ICU and SICU bed metrics
- Clean separation between descriptive attributes and measurable values
- Reliable reporting for leadership decision-making

Star Schema Design for ICU/SICU Bed Capacity Analysis

Figure 1. Star schema illustrating the dimensional model used for the analysis. The ***bed_fact*** table serves as the central fact table, capturing licensed, census, and staffed bed counts at the hospital and bed-type level. It is linked to the ***business*** and ***bed_type*** dimension tables, enabling accurate aggregation and reporting of ICU and SICU capacity across the hospital network.



A snapshot of the Star Schema

Identification of Hospitals with ICU and SICU Capacity

The first stage of the analysis focused on identifying hospitals with critical care capability. Specifically, hospitals were screened to determine whether they operated:

- Intensive Care Unit (ICU) beds (`bed_id = 4`),
- Surgical Intensive Care Unit (SICU) beds (`bed_id = 15`), or
- Both ICU and SICU units.

To accomplish this, the `bed_fact` table was joined with the `business` and `bed_type` dimension tables. Filtering on the relevant bed identifiers allowed isolation of facilities with ICU and/or SICU capacity.

This step established the population of hospitals eligible for further evaluation, ensuring that subsequent ranking and volume analyses were limited to facilities providing critical care services.

Top 10 Hospitals by Total ICU and SICU Licensed Beds

To evaluate regulatory critical care capacity, hospitals were ranked based on the total number of licensed ICU and SICU beds. Licensed beds represent the maximum number of beds a hospital is authorized to operate and serve as an indicator of potential scale.

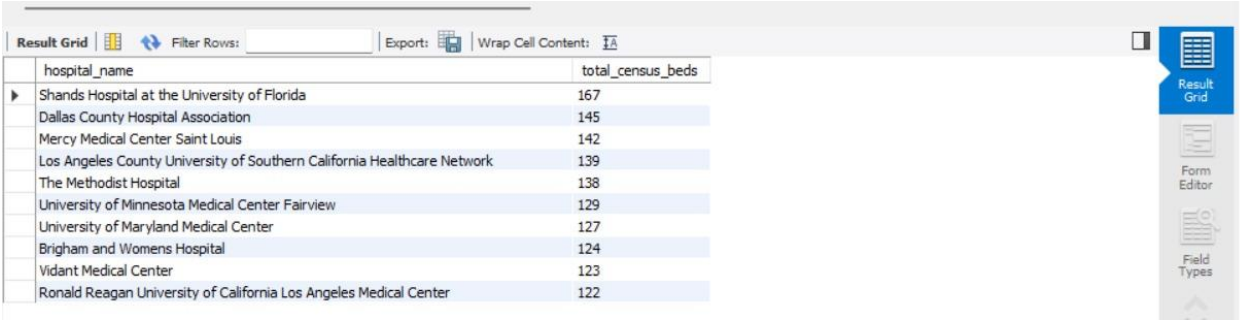
Using aggregated values from the `bed_fact` table, licensed ICU (`bed_id = 4`) and SICU (`bed_id = 15`) beds were summed at the hospital level. The results were then ordered in descending order to identify the ten hospitals with the highest licensed critical care capacity.

The table below presents the top 10 hospitals by total ICU and SICU licensed beds.

hospital_name	total_license_beds
Phoenix Childrens Hospital	247
University of Maryland Medical Center	220
UC Health University Hospital	218
Wesley Medical Center, LLC	214
Vidant Medical Center	204
Rady Childrens Hospital and Health Center	200
Dallas County Hospital Association	195
Saint Lukes Episcopal Hospital Texas Medical Center	178
The Methodist Hospital	170
Emory University Hospital	169

Top 10 Hospitals by Total ICU and SICU Census Beds

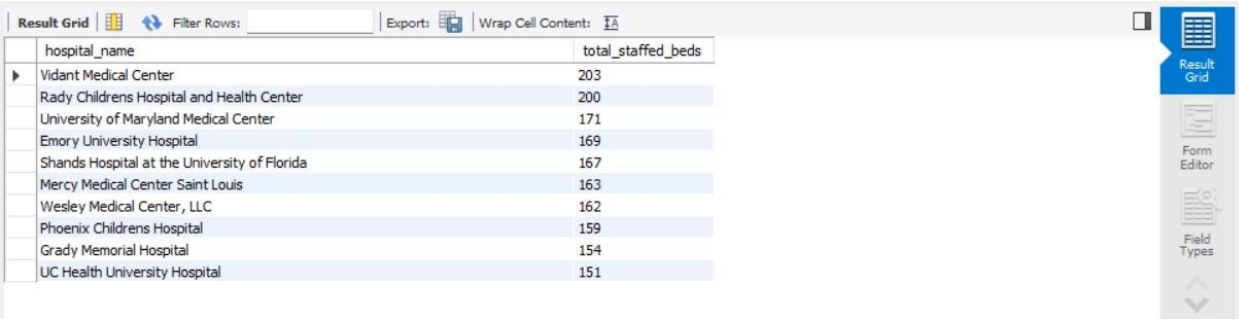
Hospitals were ranked by the total number of occupied ICU and SICU beds to assess critical care utilization. Census beds (`bed_id = 4` and `bed_id = 15`) were aggregated at the hospital level and ordered in descending order to identify the top 10 facilities by patient volume.



hospital_name	total_census_beds
Shands Hospital at the University of Florida	167
Dallas County Hospital Association	145
Mercy Medical Center Saint Louis	142
Los Angeles County University of Southern California Healthcare Network	139
The Methodist Hospital	138
University of Minnesota Medical Center Fairview	129
University of Maryland Medical Center	127
Brigham and Womens Hospital	124
Vidant Medical Center	123
Ronald Reagan University of California Los Angeles Medical Center	122

Top 10 Hospitals by Total ICU and SICU Staffed Beds

Hospitals were ranked by the total number of staffed ICU and SICU beds to evaluate operational readiness. Staffed beds were aggregated for ICU (`bed_id = 4`) and SICU (`bed_id = 15`) units and ordered in descending order to identify the top 10 facilities with the strongest active critical care capacity.



hospital_name	total_staffed_beds
Vidant Medical Center	203
Rady Childrens Hospital and Health Center	200
University of Maryland Medical Center	171
Emory University Hospital	169
Shands Hospital at the University of Florida	167
Mercy Medical Center Saint Louis	163
Wesley Medical Center, LLC	162
Phoenix Childrens Hospital	159
Grady Memorial Hospital	154
UC Health University Hospital	151

Interpretation of Findings

The three summary analyses (licensed, census, and staffed beds) highlight meaningful differences in ICU and SICU capacity across hospitals in the network.

Key Insights

1. Licensed capacity does not always reflect operational utilization

Hospitals with the highest licensed ICU/SICU bed capacity are not consistently the same hospitals with the highest census or staffed beds. This indicates that regulatory capacity alone does not guarantee sustained utilization or operational readiness. Some facilities are licensed to operate at high volume but may not consistently function at that level.

2. A subset of hospitals demonstrates consistent strength across multiple measures

Several hospitals appear across more than one ranking, indicating both scale and active use of critical care services:

- **University of Maryland Medical Center**
  Ranks highly across licensed, census, and staffed beds, reflecting balanced capacity, utilization, and staffing strength.
- **Shands Hospital at the University of Florida**
  Leads in census beds and performs strongly in staffed capacity, indicating sustained patient demand supported by operational infrastructure.
- **Vidant Medical Center**
  Shows strong licensed capacity and ranks first in staffed beds, suggesting high readiness for expanded clinical initiatives.
- **Dallas County Hospital Association**
  Appears in licensed and census rankings, indicating both regulatory scale and active utilization.
- **Rady Children's Hospital and Health Center**
  Demonstrates strong licensed and staffed ICU/SICU capacity within a pediatric setting.

Hospitals that appear across multiple lists demonstrate consistent performance rather than isolated strengths.

3. Staffed beds are the most operationally relevant metric

Among the three measures, staffed beds provide the clearest indication of immediate feasibility for a nursing intervention. This metric reflects beds that are actively supported by clinical personnel rather than theoretical or licensed capacity.

Hospitals such as University of Maryland Medical Center, Vidant Medical Center, and Emory University Hospital show strong staffed-bed capacity, making them more realistic candidates for near-term implementation.

Strategic Implications

Hospitals that consistently rank highly across licensed, census, and staffed beds present the strongest opportunity for pilot implementation. These facilities demonstrate:

- Adequate regulatory capacity
- Sustained patient utilization
- Operational staffing infrastructure

Selecting hospitals with strength across all three measures reduces implementation risk while increasing the likelihood of measurable clinical and operational impact.

Top 10 Hospitals by Total ICU and SICU Licensed Beds (Both Units Required)

To further refine the analysis, hospitals were restricted to those operating **both ICU (`bed_id = 4`) and SICU (`bed_id = 15`) units**. This ensured that only facilities with comprehensive critical care capability were included.

Licensed ICU and SICU beds were aggregated at the hospital level and ranked in descending order. The results below identify the top 10 hospitals with the largest combined licensed critical care capacity across both units.

hospital_name	total_license_beds
University of Maryland Medical Center	220
UC Health University Hospital	218
Shands Hospital at the University of Florida	167
MCGHealth, Inc	155
Grady Memorial Hospital	154
Jackson Memorial Hospital	151
University Hospital in Bexar County	144
University of Minnesota Medical Center Fairview	144
Carolinas Medical Center	137
Yale New Haven Hospital	136

Top 10 Hospitals by Total ICU and SICU Census Beds (Both Units Required)

The analysis was refined to include only hospitals operating both ICU and SICU units. Census beds were aggregated for ICU (`bed_id = 4`) and SICU (`bed_id = 15`) at the hospital level to measure active patient utilization across comprehensive critical care services.

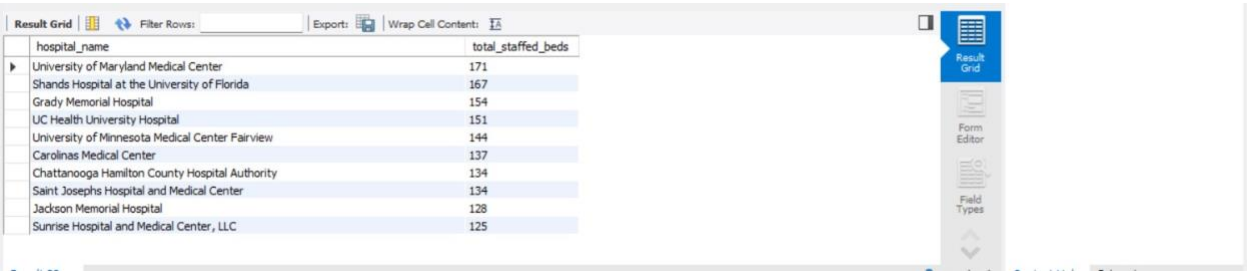
Hospitals were ranked in descending order to identify the top 10 facilities with the highest combined ICU and SICU census volume.

hospital_name	total_census_beds
Shands Hospital at the University of Florida	167
University of Minnesota Medical Center Fairview	129
University of Maryland Medical Center	127
Jackson Memorial Hospital	117
UC Health University Hospital	110
Carolinas Medical Center	106
Cedars Sinai Health System	92
Duke University Health System	91
University Hospital in Bexar County	91
Grady Memorial Hospital	88

Top 10 Hospitals by Total ICU and SICU Census Beds (Both Units Required)

The analysis was refined to include only hospitals operating both ICU and SICU units. Census beds were aggregated for ICU (`bed_id = 4`) and SICU (`bed_id = 15`) at the hospital level to measure active patient utilization across comprehensive critical care services.

Hospitals were ranked in descending order to identify the top 10 facilities with the highest combined ICU and SICU census volume.



hospital_name	total_staffed_beds
University of Maryland Medical Center	171
Shands Hospital at the University of Florida	167
Grady Memorial Hospital	154
UC Health University Hospital	151
University of Minnesota Medical Center Fairview	144
Carolinas Medical Center	137
Chattanooga Hamilton County Hospital Authority	134
Saint Josephs Hospital and Medical Center	134
Jackson Memorial Hospital	128
Sunrise Hospital and Medical Center, LLC	125

Final Recommendation

Based on the ICU and SICU capacity analysis, two hospitals stand out as the strongest candidates for the nursing intervention pilot program:

University of Maryland Medical Center

The University of Maryland Medical Center demonstrates consistent strength across all key measures of critical care capacity. It ranks at or near the top in:

- Total licensed ICU and SICU beds
- Total staffed ICU and SICU beds
- Overall census volume

This combination indicates both regulatory scale and operational readiness. The hospital's strong staffed-bed capacity suggests it has the infrastructure required to effectively support an expanded nurse-to-patient ratio while sustaining high patient demand. As a result, it represents the most robust and balanced candidate for pilot implementation.

Shands Hospital at the University of Florida

Shands Hospital exhibits the highest ICU and SICU census volume, reflecting sustained and significant patient demand in critical care settings. It also performs strongly in both licensed and staffed bed capacity and appears consistently across all major rankings when restricted to hospitals operating both ICU and SICU units.

This balance of high utilization and sufficient staffing capacity makes Shands Hospital an ideal environment to evaluate the operational and clinical impact of enhanced nursing resources.

Executive Conclusion

Selecting **University of Maryland Medical Center** and **Shands Hospital at the University of Florida** provides a well-balanced pilot cohort. Both hospitals demonstrate:

- Strong licensed capacity
- Sustained ICU and SICU utilization
- Operational staffing readiness

Deploying the nursing intervention in these facilities maximizes the likelihood of measurable clinical improvement while minimizing implementation risk. Together, they offer the most strategic environment to assess the effectiveness of improved nurse-to-patient ratios in high-acuity care settings.