Stroke Supervision & Tracking Database

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HI 2451 SEC1110: Database Design & Big Data Analytics
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April 25, 2025

Introduction

According to the American Stroke Association (ASA), stroke is the number 5 cause of death and cause of disability in the United States (American Stroke Association, 2025). A stroke occurs when a blood vessel that carries oxygen and nutrients to the brain is either blocked by a clot or proceeds to rupture. When that occurs, the brain cannot get oxygen it needs and the brain cells die (NINDS, 2024). For stroke patients, the sooner treatment begins the higher the chances doctors can save cells, reducing or even reversing the damage.

Despite the timely sensitive nature of stroke, many healthcare facilities lack centralized tracking and management applications for stroke encounters. Medical facilities without such applications may find early intervention and quality improvement initiatives difficult. This problem further delays real time clinical decision making and compounds the risk of complications for stroke patients. Implementing a centralized stroke supervision and tracking database would allow seamless information sharing between departments, streamline stroke care, and monitoring long-term outcomes.

The purpose of this project is to create a database application designed to record, track, monitor, and use reports to improve the clinical management of stroke encounters. The domain of this application is stroke supervision and tracking at Ozark Health Medical Center (OHMC), a 110-bed regional medical facility, specializing in neurology and rehabilitation. The facility adopted the Stroke Supervision and Tracking Database in 2025 and will implement it across clinical staff in the Emergency Department and Intensive Care Units.

The objectives for OHMC are to provide timely, coordinated, and compliant care for patients experiencing stroke-related incidents. Key operations for OHMC start within the emergency department responsible for immediate triage and treatment of stroke symptoms,

including CT scans, thrombolytic therapy (e.g., tPA), and rapid neurological evaluations. The Intensive Care Unit (ICU) manages critical care for severe strokes, where continuous monitoring, ventilator support, and complex medication management may be required. Both departments rely heavily on cross-functional teamwork and real-time data to supervise and monitor stroke care.

The initial assessment conducted at OHMC highlights several challenges that care teams experience due to fragmented data entry and manual tracking. This yields inconsistent reporting and places a time constraint on the facility to get accurate timely data. To address these concerns, an application interface for real-time data entry along with interactive dashboard for compliance and performance tracking will be implemented at OHMC. With a shift to digital technology, users must overcome limited IT experience for it to effectively integrate facility wide. The business rules and design of the application will provide a visualization of how users will accomplish their objectives.

Business Rules

1. Each patient is uniquely identified and can have multiple stroke encounters.
    - (1:M relationship between PATIENT and STROKE_ENCOUNTER)
2. Each stroke encounter is associated with exactly one patient.
    - (M:1 relationship from STROKE_ENCOUNTER to PATIENT)
3. Each patient is tied to one medical history records.
    - (1:1 relationship from PATIENT to PATIENT_MED_HISTORY)
4. Each treatment may be applied to multiple stroke encounters, but each encounter references only one treatment record.
    - (1:M relationship from TREATMENT to STROKE_ENCOUNTER)
5. Each stroke encounter can be checked against multiple guidelines for compliance.

- (M:N relationship between STROKE_ENCOUNTER and GUIDELINE resolved through COMPLIANCE_CHECK)

6. Each guideline can be referenced in multiple compliance checks.

- (1:M relationship from GUIDELINE to COMPLIANCE_CHECK)

7. Each compliance check must be linked to one stroke encounter and one guideline.

- (Each COMPLIANCE_CHECK row has FK to both STROKE_ENCOUNTER and GUIDELINE)

8. Each compliance check may have associated data quality issues, tracked via the DATA_QUALITY_FLAG entity.

- (M:N relationship between COMPLIANCE_CHECK and STROKE_ENCOUNTER resolved through DATA_QUALITY_FLAG)

9. Each data quality flag describes an issue type and resolution status, and links to a specific compliance check and stroke encounter.

- (1:1 or 1:M depending on implementation, from DATA_QUALITY_FLAG to both STROKE_ENCOUNTER and COMPLIANCE_CHECK)

10. BMI and Avg_Glucose attributes represent a clinical snapshot value at the time of stroke encounter and can be updated upon each encounter.

Design

ENTITY RELATIONSHIP DIAGRAM (ERD)

- **Note:** Updated to add Patient_Med_History (new entity). BMI and Avg_Glucose were moved to STROKE_ENCOUNTER entity. Attributes in STROKE_ENCOUNTER such as arrival/departure date were changed to Date_Occured for clarity.

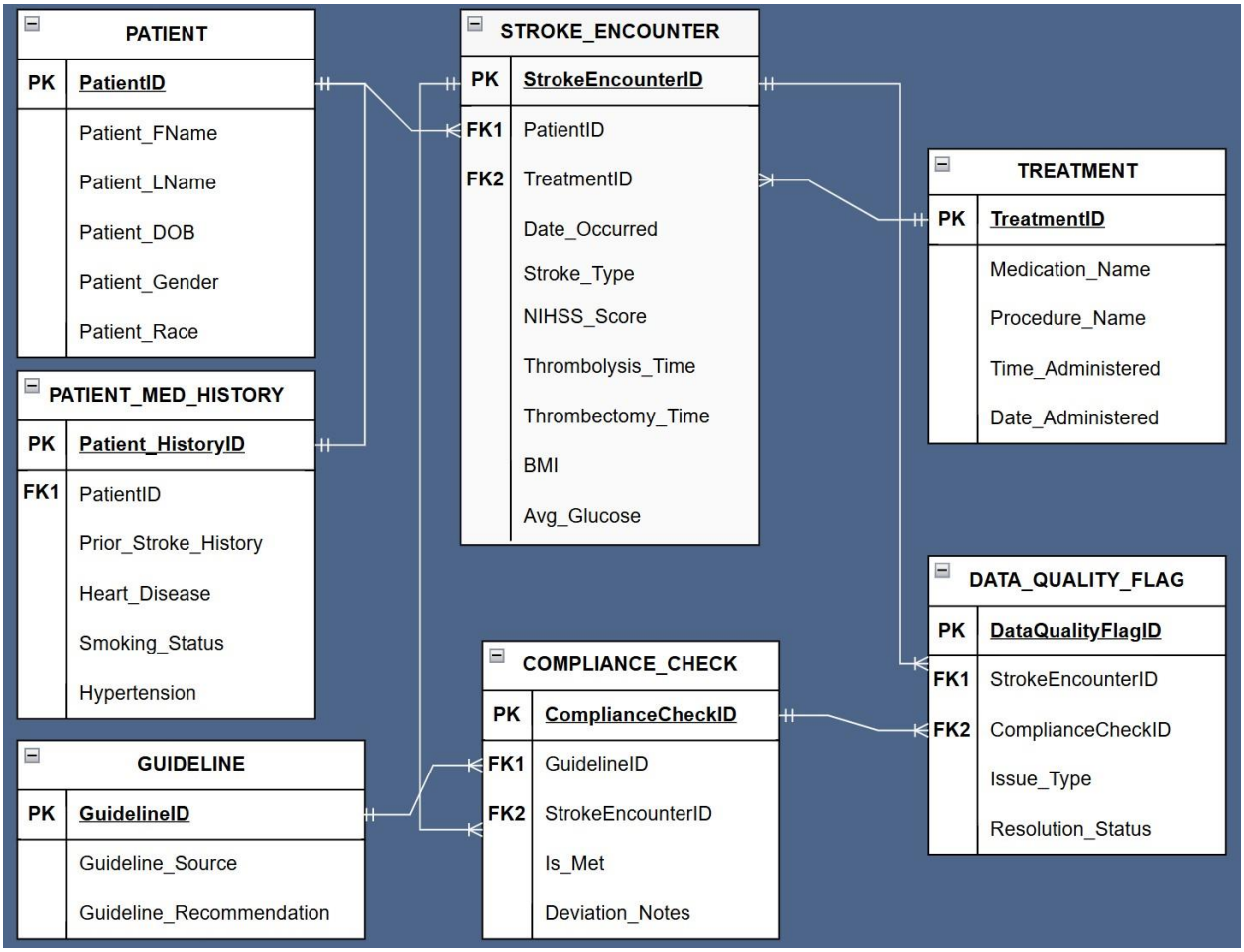

FIGURE 1

DATA DICTIONARY

- **Note:** Updated to add Patient_Med_History (new entity) and realign attributes post live demonstration guidance.

Entity	Attribute	Data Type	Description	PK or FK
PATIENT	PatientID	VARCHAR (50)	Unique identifier for each patient	PK
	Patient_FName	VARCHAR (50)	First name of the patient	
	Patient_LName	VARCHAR (50)	Last name of the patient	
	Patient_DOB	DATE	Date of birth of the patient	
	Patient_Gender	CHAR (1)	Gender of the patient (e.g., M/F)	
	Patient_Race	VARCHAR (50)	Race/ethnicity of the patient	
PATIENT_MED_HISTORY	Patient_HistoryID	INT	Unique identifier for each patient	PK
	PatientID	VARCHAR (50)	Reference to the associated patient	FK
	Prior_Stroke_History	VARCHAR (3)	Patient medical details of the patient	
	Heart_Disease	VARCHAR (3)	Indicates patient diagnosis of heart disease (e.g. 'Yes', 'No')	
	Smoking_Status	VARCHAR (50)	Categorical smoking history of the patient (e.g., 'never smoked', 'formerly smoked', 'smokes').	
	Hypertension	VARCHAR (3)	Indicates patient history of hypertension (e.g. 'Yes', No')	
STROKE_ENCOUNTER	StrokeEncounterID	INT	Unique identifier for each stroke encounter	PK
	PatientID	VARCHAR (50)	Reference to the associated patient	FK
	TreatmentID	INT	Reference to the associated treatment	FK
	Date_Occurred	DATETIME	Date when stroke encounter occurred	
	Stroke_Type	VARCHAR (50)	Type of stroke (e.g., ischemic, hemorrhagic)	
	NIHSS_Score	INT	NIH Stroke Scale score	
	Thrombolysis_Time	DATETIME	Time when thrombolysis was administered	
	Thrombectomy_Time	DATETIME	Time when thrombectomy was performed	
	BMI	VARCHAR (10)	Body Mass Index of patient, calculated as weight (kg) / height (m2)	
	Avg_Glucose	VARCHAR (10)	Patient's average blood glucose level measured in mg/dL	
TREATMENT	TreatmentID	INT	Unique identifier for each treatment	PK
	Medication_Name	VARCHAR (100)	Name of medication administered	
	Procedure_Name	VARCHAR (100)	Name of procedure performed	
	Time_Administered	TIME	Time when treatment was administered	
	Date_Administered	DATE	Date when treatment was administered	
GUIDELINE	GuidelineID	INT	Unique identifier for each guideline	PK
	Guideline_Source	VARCHAR (100)	Source or origin of the guideline	
	Guideline_Recommendation	TEXT	Recommendation details	
COMPLIANCE_CHECK	ComplianceCheckID	INT	Unique identifier for each compliance check	PK
	GuidelineID	INT	Reference to associated guideline	FK
	StrokeEncounterID	INT	Reference to associated stroke encounter	FK
	Is_Met	BOOLEAN	Whether compliance was met	
	Deviation_Notes	TEXT	Notes on any deviations from guidelines	
DATA_QUALITY_FLAG	DataQualityFlagID	INT	Unique identifier for each data quality flag	PK
	StrokeEncounterID	INT	Reference to associated stroke encounter	FK
	ComplianceCheckID	INT	Reference to associated compliance check	FK
	Issue_Type	VARCHAR (100)	Description of data quality issue	
	Resolution_Status	VARCHAR (50)	Status of issue resolution (e.g., resolved/unresolved)	

FIGURE 2

DESIGN: USER INTERFACE (MS ACCESS)

MAIN MENU

- **Note:** Updated to add Patient History Form (new entity).

FIGURE 3

PATIENT FORM

- **Note:** Updated to remove attributes that now fall under new entity (table).

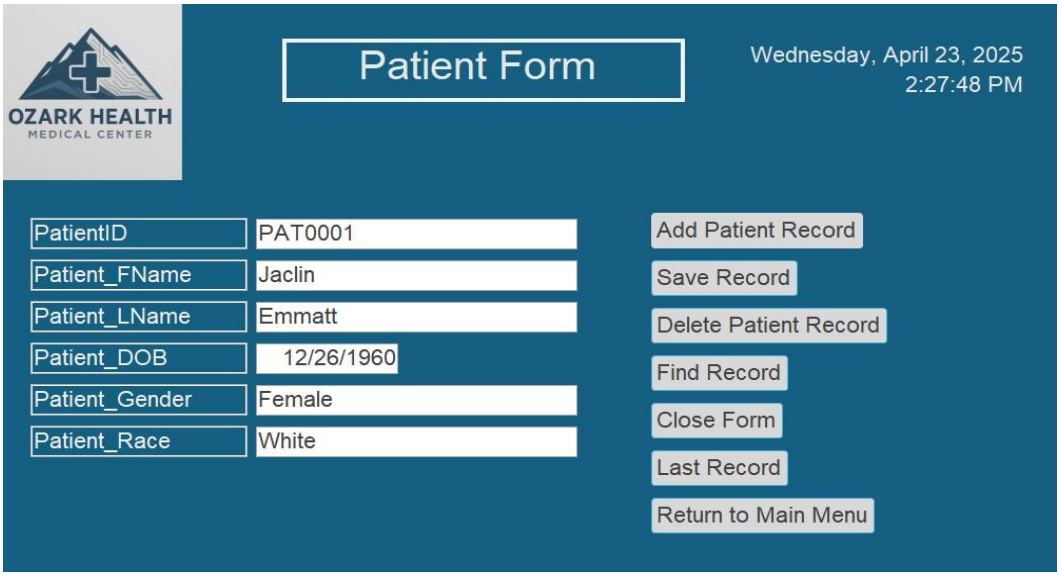

FIGURE 4

DESIGN: REPORTS/QUERIES (MS ACCESS & POWER BI)

MS ACCESS QUERY 1: GUIDELINE COMPLIANCE QUERY

- **Note:** Title of 'Arrival_Time' in 'STROKE_ENCOUNTER' entity was changed to 'Date_Occurred' post Live Demonstration.

GuidelineID	Is_Met	Date_Occurred
G0001	No	4/10/2025 8:11:56 PM
G0002	Yes	4/10/2025 5:35:00 AM
G0003	Yes	4/10/2025 10:55:05 PM
G0004	No	4/10/2025 1:11:50 AM
G0005	No	4/10/2025 4:25:13 PM
G0006	Yes	4/10/2025 9:00:08 PM
G0007	Yes	4/10/2025 7:54:05 AM
G0008	No	4/10/2025 10:49:52 PM
G0009	No	4/10/2025 6:00:29 AM

FIGURE 5

MS ACCESS QUERY 2: STROKE ENCOUNTER

StrokeEncou	Stroke_Type	NIHSS_Score	Patient_FNar	Patient_LNar	Date_Occurred
SE0001	Hemorrhagic	4	Jaclin	Emmatt	4/10/2025 8:11:56 PM
SE0002	Ischemic	10	Ginnie	Riediger	4/10/2025 5:35:00 AM
SE0003	TIA	31	Mildred	Kitcherside	4/10/2025 10:55:05 PM
SE0004	Hemorrhagic	30	Devan	Burnett	4/10/2025 1:11:50 AM
SE0005	TIA	2	Maynord	Doley	4/10/2025 4:25:13 PM
SE0006	Ischemic	3	Kaile	Quinet	4/10/2025 9:00:08 PM
SE0007	Hemorrhagic	24	Nester	Tulk	4/10/2025 7:54:05 AM
SE0008	Hemorrhagic	17	Balduin	Pepall	4/10/2025 10:49:52 PM
SE0009	Hemorrhagic	4	Aldwin	Mottershead	4/10/2025 6:00:29 AM
SE0010	Hemorrhagic	15	Lyssa	Driutti	4/10/2025 9:47:00 PM

FIGURE 6

POWER BI REPORTS & VISUALIZATION

- **Note:** Updated to reflect correct title (bottom left chart - Stroke Encounters).

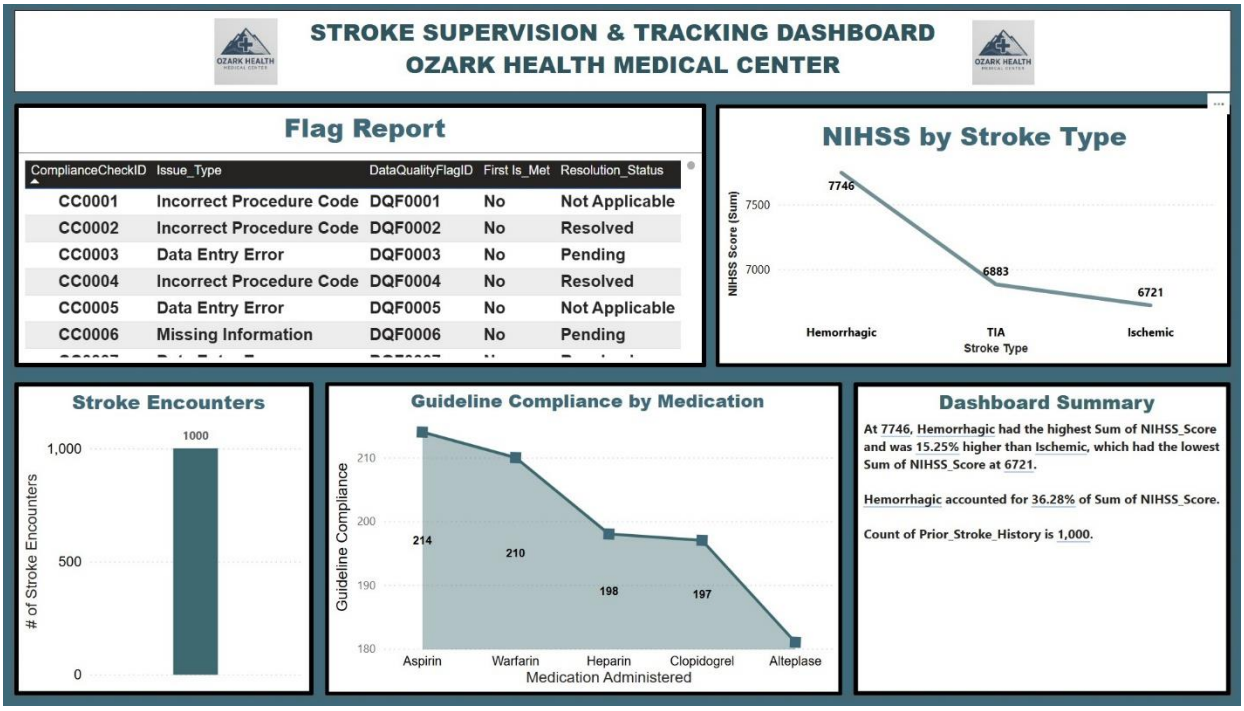

FIGURE 7

Detailed Design Specifications

The computer design for this project utilizes SQL Server (SSMS), Microsoft (MS) Access, and Power Business Intelligence (BI). SSMS is our centralized relational database for storing stroke data (e.g., encounters, guidelines, and patient information). MS Access is our designated user interface for data entry, editing, and building queries used by nurses, analysts, and care team members. It is linked to SQL Server for real time data. Lastly, the visualization is conducted in Power BI to generate a consolidated dashboard for compliance reports and trends. The security of SSM includes assigning role-based permissions using Windows Authentication with Active Directory. The data encryption feature is Transparent Data Encryption (TDE) at rest and SSL/TLS for traffic in between MS Access/Power BI and SSMS. In MS Access and Power

BI important controls must be set to ensure protected health information is secured such as restricting export or sharing permissions and applying auto-logout features.

Maintenance Plan

To maintain our database the database administrator will monitor performance and address slow queries and review error logs in SSMS. The compliance team will run weekly audit reports of those who accessed and updated various products to ensure standardization and security measures are adhered to. Quarterly at a minimum, the compliance team will conduct risk assessments for HIPAA compliance. There should be an audit trail available for those who have access to protected health information. All reports and visualizations must be monitored and refreshed to ensure data is pushed in a timely manner.

Hands-on training and demonstrations for clinical staff will be conducted by the clinical educator. This training includes the use of MS Access user interface. The data analytics and informatics team will train on how to assess the MS Access queries and Power BI dashboards. This can be routine small group led training or local procedures established for standardization. The IT team will conduct familiarization training on troubleshooting backend, frontend, and Power BI connections. And lastly, the senior leadership or executives must be trained in how to interpret the trends and have space to provide feedback. The database needs to be a useful tool that is flexible and can be altered to meet the goals of OHMC. Training tools include start up guides for MS Access and Power BI, recorded live demos for reference, and a cyclic training session for the first three months to ensure all staff are comfortable with the tools and can provide feedback.

Discussion

Limitations of the Stroke Supervision and Tracking Database include performance constraints in MS Access. Although easy to use, MS Access does not expand or scale up simply for high-volume data. The speed at which staff can pull reports and queries may slow over time as more data is stored. Second, during the connection of Power BI to MS Access, the field and relationships were signaling an error thus realignment with SQL Server instead. It is important to maintain relationships in the infrastructure from SSMS all the way through data visualization so that the reports are effective tools in driving clinical decisions. Lastly, the workflow integration with Electronic Health Records (EHR) is not addressed in this application. To avoid redundant or inconsistent health information, could this database application be tied to EHRs for streamlined data? Without further integration, this system remains siloed rather than part of a larger healthcare solution.

This suggestion leads to further development opportunities. Using auto-imported data feeds from EHRs reduces manual data entry and improve accuracy of information. If scaling occurs due to large volume of data, it could be possible to push MS Access to a web-based application using other tools. Additionally, audit logs and timestamped reports can be ready for The Joint Commission performance review and accreditation. In conclusion, the Stroke Database achieved initial objectives to track and enter patient encounters. Future iterations may benefit from enhancing automation better aligned with clinical workflows.

Appendix

Appendix A: SQL Script – See attached document.

References

American Stroke Association. (2025). *Stroke Symptoms*. Retrieved 2025, March 20, https://www.stroke.org/en/about-stroke

National Institute of Neurological Disorders and Stroke. (2024, September 11). *Stroke*. Retrieved 2025, March 20, https://www.ninds.nih.gov/health-information/stroke/stroke-overview