Personal Health Management

Database Management and Database Design

Team-3

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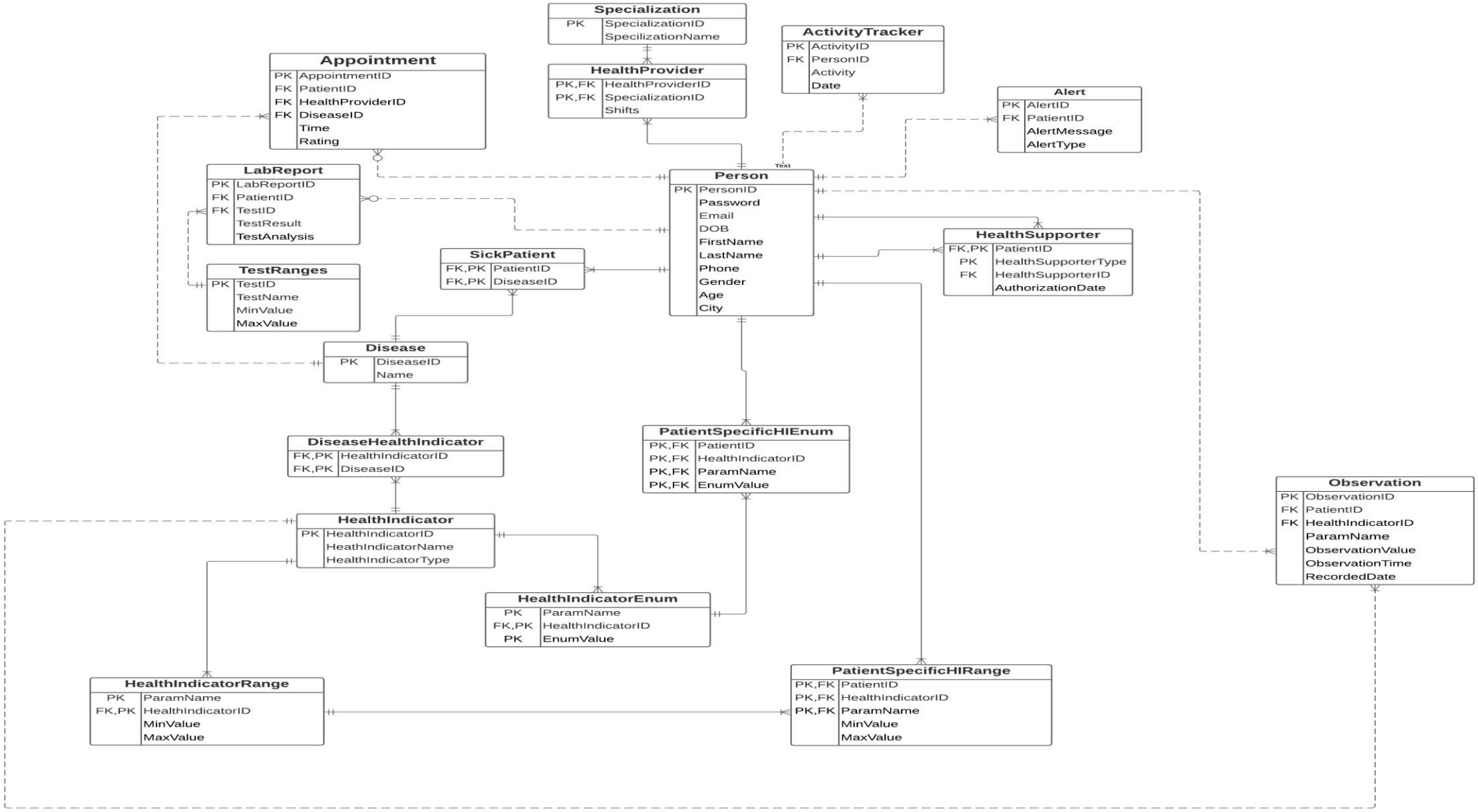
Database Purpose

Track patient's health specific information like Observations, Appointments and Activity

Alert the health supporters in cases of criticality

Reduce the chances of severity in the already existing medical conditions by reporting the abnormalities

Entity Relationship Diagram



Column Data Encryption

```
---create DMK--
CREATE MASTER KEY
ENCRYPTION BY PASSWORD ='P@$$WORD';

---create certificate---
CREATE CERTIFICATE TestCertificate
WITH SUBJECT = 'Team3 Project Certificate',
EXPIRY_DATE = '2025-10-05'

---create certificate for encryption---
CREATE SYMMETRIC KEY TestSymmetricKey
WITH ALGORITHM = AES_128
ENCRYPTION BY CERTIFICATE TestCertificate


---open symmetric key---
OPEN SYMMETRIC KEY TestSymmetricKey
DECRYPTION BY CERTIFICATE TestCertificate
```

Results Messages

	PersonId	FirstName	LastName	EncryptedPassword	Age
1	1	Geetha	Sreepada	0x00B6C6156EE8CC4BBD2AA8C…	26
2	2	Swati	Bhojwani	0x00B6C6156EE8CC4BBD2AA8C…	26
3	3	Amrutha	Gupta	0x00B6C6156EE8CC4BBD2AA8C…	30
4	4	Maheswari	kanti	0x00B6C6156EE8CC4BBD2AA8C…	25
5	5	Yeshu	Gupta	0x00B6C6156EE8CC4BBD2AA8C…	30
6	6	Sahithi	Sarabu	0x00B6C6156EE8CC4BBD2AA8C…	26
7	7	Mahendra	Dhoni	0x00B6C6156EE8CC4BBD2AA8C…	36
8	8	Keerthi	Spada	0x00B6C6156EE8CC4BBD2AA8C…	46
9	9	Virat	Kohli	0x00B6C6156EE8CC4BBD2AA8C…	29
10	10	Lakshmi	Veda	0x00B6C6156EE8CC4BBD2AA8C…	26

Table-level CHECK Constraint based on Function

```
CREATE FUNCTION dbo.checkDocRating(@hid INT)
RETURNS FLOAT
AS
BEGIN
DECLARE @avg FLOAT = (SELECT AVG(Rating)
FROM dbo.Appointment
WHERE HealthProviderID = @hid);
RETURN @avg;
END
```

```
INSERT INTO Appointment
    (PatientID,HealthProviderID,DiseaseID, Rating,Time)
VALUES(1, 7, 4, 0, '2020-11-30 10:34:09 AM')
```

Messages

12:55:59 PM Started executing query at Line 110

Msg 547, Level 16, State 0, Line 1

The INSERT statement conflicted with the CHECK constraint "BookWithGoodDoc". The conflict occurred in database "TEAM3", table "dbo.Appointment", column 'HealthProviderID'.

The statement has been terminated.

Total execution time: 00:00:00.017

Computed Column based on Function

```
CREATE FUNCTION dbo.AnalyzeTestResult(@tid INT, @tresult FLOAT)
RETURNS VARCHAR(20)
AS
BEGIN
DECLARE @Out VARCHAR(20);
DECLARE @Min FLOAT = (SELECT MinValue
FROM dbo.TestRanges
WHERE TestID = @tid);
DECLARE @Max FLOAT = (SELECT MaxValue
FROM dbo.TestRanges
WHERE TestID = @tid);
IF @tresult < @Min OR @tresult > @Max
BEGIN
SET @Out = 'Abnormal';
END
ELSE
BEGIN
SET @Out = 'Normal';
END
RETURN @Out;
END
```

```
INSERT INTO LabReport (PatientID ,TestID ,TestResult )
VALUES (2,1,3.4)
select * from LabReport
```

Results | Messages

	LabReportID	PatientID	TestID	TestResult	TestAnalysis
1	1	1	1	3.3	Abnormal
2	2	1	2	6.7	Normal
3	3	1	3	12	Normal
4	4	1	4	2	Normal
5	5	1	5	256	Normal
6	6	1	6	83	Normal
7	7	2	7	28	Normal
8	8	2	1	3.4	Abnormal

Trigger to generate Alerts

```
---Trigger to generate alert on Insert to observation
CREATE TRIGGER Generate_Alert ON dbo.Observation
FOR  INSERT
AS
BEGIN
    DECLARE @PatientID INT = (SELECT PatientID FROM inserted);
    DECLARE @HI INT = (SELECT HealthIndicatorID FROM inserted);
    DECLARE @Param VARCHAR(30) = (SELECT ParamName FROM inserted);
    DECLARE @Min FLOAT;
    DECLARE @Max FLOAT;
    DECLARE @ObservationValue VARCHAR(30) = (SELECT ObservationValue FROM inserted);
    DECLARE @NumPatientSpecificRangeValues INT = (SELECT COUNT(*) FROM PatientSpecificHIRange WHERE PatientID = @PatientID AND HealthIndicatorID = @HI);
    DECLARE @NumPatientSpecificEnumValues INT = (SELECT COUNT(*) FROM PatientSpecificHIEnum WHERE PatientID = @PatientID AND HealthIndicatorID = @HI);
    DECLARE @NumRegularRangeValues INT = (SELECT COUNT(*) FROM HealthIndicatorRange WHERE HealthIndicatorID = @HI);
    DECLARE @NumRegularEnumValues INT = (SELECT COUNT(*) FROM HealthIndicatorEnum WHERE HealthIndicatorID = @HI);

    IF @NumPatientSpecificRangeValues > 0
    BEGIN
        SELECT @Min = MinValue,
        @Max = MaxValue
        FROM PatientSpecificHIRange WHERE PatientID = @PatientID AND HealthIndicatorID = @HI AND ParamName = @Param;
        IF(CAST(@ObservationValue AS INT) < @Min OR CAST(@ObservationValue AS INT) > @Max)
        BEGIN
            INSERT INTO Alert VALUES(@PatientID,'OUTSIDE_LIMIT_ALERT',
            CONCAT(@ObservationValue, ' is beyond the minimum ', @Min, ' and the maximum ', @Max, ' for ', @HI, '-',@Param));
        END
    END
    ELSE
        IF @NumRegularRangeValues > 0
        BEGIN
            SELECT @Min = MinValue,
            @Max = MaxValue
            FROM HealthIndicatorRange WHERE HealthIndicatorID = @HI AND ParamName = @Param;
            IF(CAST(@ObservationValue AS INT) < @Min OR CAST(@ObservationValue AS INT) > @Max)
            BEGIN
                INSERT INTO Alert VALUES(@PatientID,'OUTSIDE_LIMIT_ALERT',
                CONCAT(@ObservationValue, ' is beyond the minimum ', @Min, ' and the maximum ', @Max, ' for ', @HI, '-',@Param));
            END
        END
```

```
INSERT dbo.Observation
VALUES
(1, 2, 'Systolic', 1000, '18:20:11', '2020-11-29')
```

	AlertID	PatientID	AlertType	AlertMessage
1	1	1	OUTSIDE_LIMIT_ALERT	11 is beyond the minimum 120 and the maximum 140 for 2-Systolic
2	2	1	SEVERITY_ALERT	Dry is not in acceptable values for 9-Cough
3	3	2	SEVERITY_ALERT	Dry is not in acceptable values for 9-Cough
4	4	2	OUTSIDE_LIMIT_ALERT	11 is beyond the minimum 120 and the maximum 140 for 2-Systolic
5	5	3	OUTSIDE_LIMIT_ALERT	11 is beyond the minimum 120 and the maximum 140 for 2-Systolic
6	6	2	SEVERITY_ALERT	Dry is not in acceptable values for 9-Cough
7	7	2	SEVERITY_ALERT	Dry is not in acceptable values for 9-Cough
8	8	3	OUTSIDE_LIMIT_ALERT	11 is beyond the minimum 120 and the maximum 140 for 2-Systolic
9	9	4	SEVERITY_ALERT	Dry is not normal, for 9-Cough
10	10	4	SEVERITY_ALERT	Dry is not normal, for 9-Cough
11	11	1	OUTSIDE_LIMIT_ALERT	1000 is beyond the minimum 110 and the maximum 130 for 2-Systolic

Trigger to generate Alerts (Cont'd)

```
    ELSE
        IF @NumPatientSpecificEnumValues > 0
        BEGIN
            --- Check if there's a patient specific enum value for which alert should not be generated
            DECLARE @count INT = (SELECT count(*) FROM PatientSpecificHIEnum WHERE PatientID = @PatientID AND HealthIndicatorID = @HI AND EnumValue = @ObservationValue);
            IF(@count = 0)
            BEGIN
                INSERT INTO Alert VALUES(@PatientID, 'SEVERITY_ALERT',
                CONCAT(@ObservationValue, ' is not in acceptable values for ', @HI, '-',@Param));
            END
        END
    ELSE
        IF @NumRegularEnumValues > 0
        BEGIN
            IF(@ObservationValue <> 'None' AND @ObservationValue <> 'Happy')
            BEGIN
                INSERT INTO Alert VALUES(@PatientID, 'SEVERITY_ALERT',
                CONCAT(@ObservationValue, ' is not normal, for ', @HI, '-',@Param));
            END
        END
END
```

```
INSERT dbo.Observation
VALUES
(4, 9, 'Cough', 'Dry', '18:20:11', '2020-11-29')
```

	AlertID	PatientID	AlertType	AlertMessage
1	1	1	OUTSIDE_LIMIT_ALERT	11 is beyond the minimum 120 and the maximum 140 for 2-Systolic
2	2	1	SEVERITY_ALERT	Dry is not in acceptable values for 9-Cough
3	3	2	SEVERITY_ALERT	Dry is not in acceptable values for 9-Cough
4	4	2	OUTSIDE_LIMIT_ALERT	11 is beyond the minimum 120 and the maximum 140 for 2-Systolic
5	5	3	OUTSIDE_LIMIT_ALERT	11 is beyond the minimum 120 and the maximum 140 for 2-Systolic
6	6	2	SEVERITY_ALERT	Dry is not in acceptable values for 9-Cough
7	7	2	SEVERITY_ALERT	Dry is not in acceptable values for 9-Cough
8	8	3	OUTSIDE_LIMIT_ALERT	11 is beyond the minimum 120 and the maximum 140 for 2-Systolic
9	9	4	SEVERITY_ALERT	Dry is not normal, for 9-Cough
10	10	4	SEVERITY_ALERT	Dry is not normal, for 9-Cough
11	11	1	OUTSIDE_LIMIT_ALERT	1000 is beyond the minimum 110 and the maximum 130 for 2-Systolic

View Detailing Patient's Details

```
--- View 1: Patient Lab Report
CREATE VIEW Patient_LabReport
AS
SELECT p.FirstName,p.LastName, p.Gender, p.DOB, p.Email, p.Age, p.Phone,
    (SELECT FirstName FROM Person WHERE PersonID = h.HealthSupporterID)
    AS HealthSupporterFirstName,
    (SELECT LastName FROM Person WHERE PersonID = h.HealthSupporterID)
    AS HealthSupporterLastName,
    h.AuthorizationDate, h.HealthSupporterType,
    (SELECT TestName FROM TestRanges WHERE TestID = l.TestID)
    AS TestName, l.TestResult, l.TestAnalysis
FROM dbo.Person p
JOIN dbo.LabReport l
ON p.PersonID = l.PatientID
JOIN dbo.HealthSupporter h
ON p.PersonID = h.PatientID
```

	FirstName	LastName	Gender	DOB	Email	Age	Phone	HealthSupporterFirstName	HealthSupporterLastName	AuthorizationDate	HealthSupporterType	TestName	TestResult	TestAnalysis
1	Geetha	Sreepada	F	1994-02-08	geetha.sreepada@gmail.com	26	4252410372	Keerthi	Spada	2020-02-11	Primary	RBC	3.3	Abnormal
2	Geetha	Sreepada	F	1994-02-08	geetha.sreepada@gmail.com	26	4252410372	Keerthi	Spada	2020-02-11	Primary	WBC	6.7	Normal
3	Geetha	Sreepada	F	1994-02-08	geetha.sreepada@gmail.com	26	4252410372	Keerthi	Spada	2020-02-11	Primary	Hemoglobin	12	Normal
4	Geetha	Sreepada	F	1994-02-08	geetha.sreepada@gmail.com	26	4252410372	Keerthi	Spada	2020-02-11	Primary	ESR	2	Normal
5	Geetha	Sreepada	F	1994-02-08	geetha.sreepada@gmail.com	26	4252410372	Keerthi	Spada	2020-02-11	Primary	PLT	256	Normal
6	Geetha	Sreepada	F	1994-02-08	geetha.sreepada@gmail.com	26	4252410372	Keerthi	Spada	2020-02-11	Primary	MCV	83	Normal
7	Amrutha	Gupta	F	1990-01-08	amrutha.gupta.com	30	6252410372	Keerthi	Spada	2020-07-21	Secondary	ESR	3	Normal
8	Amrutha	Gupta	F	1990-01-08	amrutha.gupta.com	30	6252410372	Keerthi	Spada	2020-07-21	Secondary	MHC	29	Normal
9	Geetha	Sreepada	F	1994-02-08	geetha.sreepada@gmail.com	26	4252410372	Virat	Kohli	2020-06-13	Secondary	RBC	3.3	Abnormal
10	Geetha	Sreepada	F	1994-02-08	geetha.sreepada@gmail.com	26	4252410372	Virat	Kohli	2020-06-13	Secondary	WBC	6.7	Normal

View Detailing Tests Taken by Patients

```sql
--- View 2: Patient's Lab Tests Report
CREATE VIEW PatientLabTests_vw
AS
WITH temp
as
(SELECT p.PersonID
AS PatientID,p.FirstName, p.LastName,
STUFF((SELECT ', '+ RTRIM(CAST((SELECT TestName FROM TestRanges WHERE TestID = l.TestID)
    AS VARCHAR)) FROM dbo.LabReport l
WHERE l.PatientID = p.PersonID for XML
PATH('')), 1, 2, '') AS [Patient's Lab Tests] FROM dbo.Person p)
SELECT t.PatientID, t.FirstName, t.LastName, t.[Patient's Lab Tests]
FROM temp t
WHERE [Patient's Lab Tests] IS NOT NULL
```

Results Messages

	PatientID	FirstName	LastName	Patient's Lab Tests
1	1	Geetha	Sreepada	RBC, WBC, Hemoglobin, ESR, PLT, MCV
2	2	Swati	Bhojwani	MHC, RBC, WBC, Hemoglobin, Hemoglobin, …
3	3	Amrutha	Gupta	ESR, MHC
4	4	Maheswari	kanti	PLT, MCV

View Showing Patient's Observations

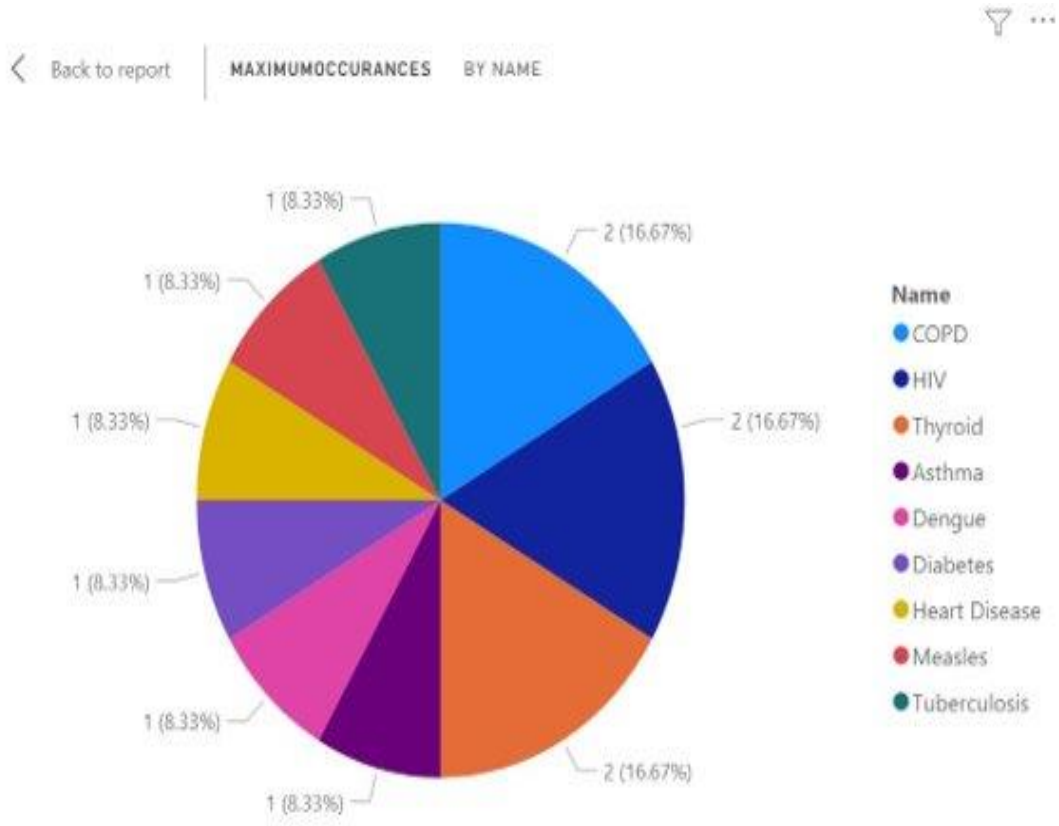
```
--- View 3: Patient's Observation Report
CREATE VIEW PatientObservation_vw
WITH ENCRYPTION, SCHEMABINDING
AS
SELECT p.FirstName, p.LastName, p.Gender, p.Age, p.DOB,
    o.ParamName
    AS HealthIndicatorMeasured, o.ObservationTime, o.ObservationValue, o.RecordedDate
FROM dbo.Person p
JOIN dbo.Observation o
ON p.PersonID = o.PatientID
```

Results Messages

	FirstName	LastName	Gender	Age	DOB	HealthIndicatorMeasured	ObservationTime	ObservationValue	RecordedDate
1	Geetha	Sreepada	F	26	1994-02-08	Weight	18:20:11	120	2017-09-09
2	Geetha	Sreepada	F	26	1994-02-08	Diastolic	18:21:11	56	2017-10-09
3	Geetha	Sreepada	F	26	1994-02-08	Oxygen Saturation	19:20:11	98	2018-09-09
4	Swati	Bhojwani	F	26	1994-02-09	Oxygen Saturation	18:20:11	98	2017-09-10
5	Geetha	Sreepada	F	26	1994-02-08	Temperature	20:20:11	99	2009-09-09
6	Swati	Bhojwani	F	26	1994-02-09	Temperature	18:20:10	99	2007-09-09
7	Geetha	Sreepada	F	26	1994-02-08	Sugar Level	18:23:11	150	2017-08-09

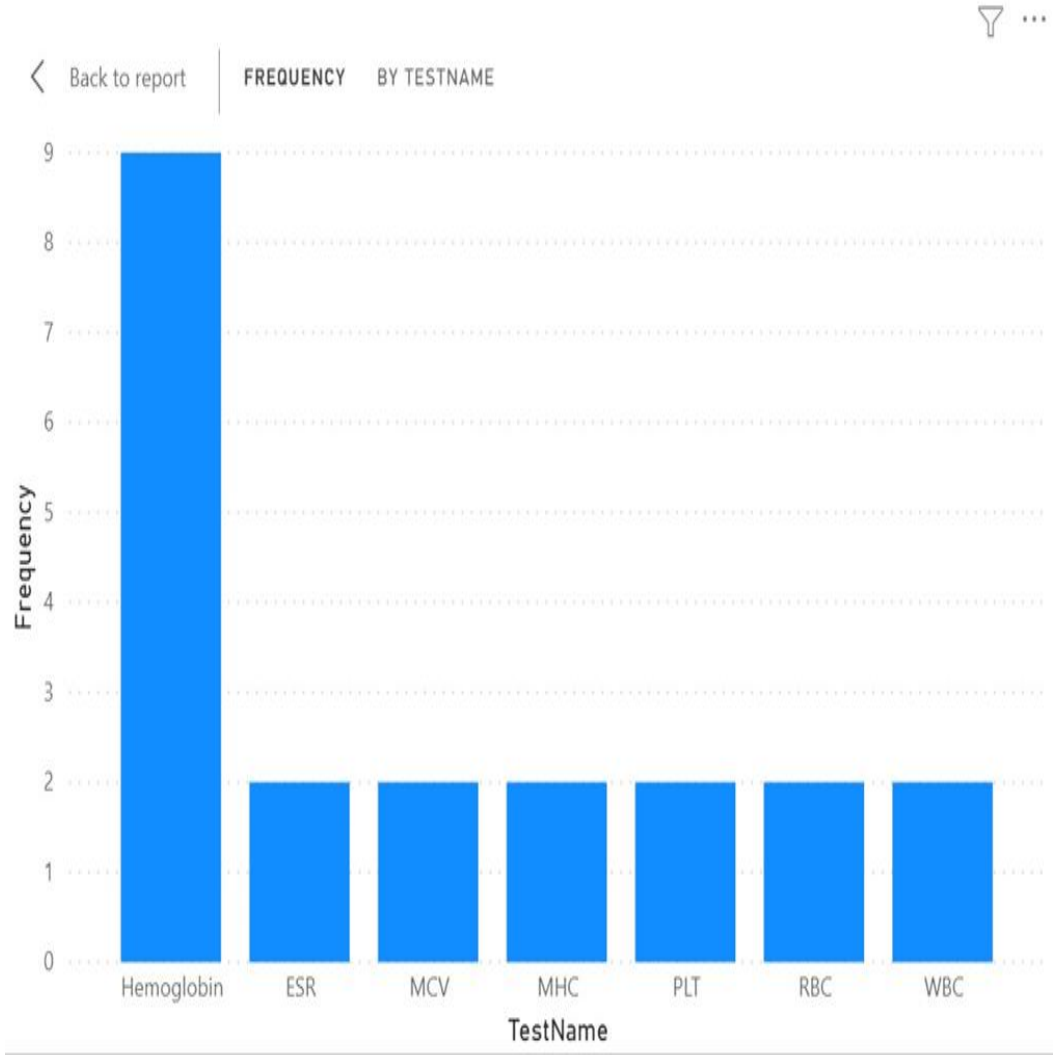
Most Common Diseases Reported

```
--- View 4: Maximum Disease Occurance
CREATE VIEW MaximumDiseaseOccurance_vw
AS
SELECT TOP 2147483647 d.Name, COUNT(s.PatientID)
AS MaximumOccurances
FROM SickPatient s
JOIN Disease d
ON s.DiseaseID = d.DiseaseID
GROUP BY d.Name
ORDER BY COUNT(s.PatientID) DESC
```



Frequent Tests Taken

```sql
--- View 5: Most Tests Taken
CREATE VIEW MostTestsTaken_vw
AS
SELECT TOP 2147483647 t.TestName, COUNT(l.PatientID) AS Frequency
FROM LabReport l
JOIN TestRanges t
ON l.TestID = t.TestID
GROUP BY t.TestName
ORDER BY COUNT(l.PatientID) DESC
```



Conclusion

We presented a database that records patient's health to assist them track and manage health status information.

Patients and Health Supporters can keep track of patient's observation values about certain health indicators and daily activities.

By analyzing data using SQL queries and presenting in Power BI, we can help patients with recording and monitoring specific health indicators, raise alerts by notifying health supporter.

Thank You!!!

Any Questions??