Healthcare Analytics for Patient Care : Transmitted Infections among Blood Donors

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April 2024

1 Introduction

Transmitted infections present a significant healthcare concern, particularly in the context of blood transfusions, where viruses like HIV and hepatitis B and C, along with bacterial infections such as syphilis, can be transmitted from donors to recipients. Despite the essential nature of blood transfusions in medical care, unsafe practices can lead to transfusion-transmitted diseases (TTDs). Preventing the transmission of these infections through blood transfusions is one of the greatest challenges in transfusion medicine. It is crucial to screen donors for high-risk behavior and implement stringent safety measures to minimize these risks.

Contributors

1. **Assessing TTI prevalence among blood donors:** The paper [4] proposes an approach which comprises the design of a cross-sectional study using seroprevalence testing.

2. **Evaluating seroprevalence of viral TTI among blood donors:** The paper [2] proposes an approach which comprises the design of a retrospective study using third generation ELISA tests.

3. **Assessing the prevalence of TTIs in blood donors over a three and a half year period:** The paper [1] proposes an approach which comprises the design of a retrospective study using blood samples from Lady Reading Hospital and screening tests for HBs Ag, anti-HCV, anti-HIV, and syphilis.

4. **Improving blood safety through voluntary non-remunerated blood donation and quality assured screening:** The paper [9] proposes an approach which comprises promoting voluntary non-remunerated blood donation and implementing quality assured screening methods using standardized operating procedures.

5. **Ensuring blood transfusion safety through stringent donor screening protocols:** The paper [6] proposes an approach which comprises designing stringent donor screening protocols using reliable screening tests.

6. **Enhancing blood transfusion safety in Pakistan with a nationwide hemovigilance system:** The paper [5] proposes an approach which comprises the design of a nationwide hemovigilance system using universal quality-assured donor screening and standardized procedures.

7. **Reducing transfusion-transmitted infections through donor selection and public awareness:** The paper [3] proposes an approach which comprises emphasizing the selection of voluntary donors, comprehensive screening using standard methods, and enhancing public awareness and education.

8. **Detecting and classifying malware using a hybrid deep learning model:** The paper [8] proposes an approach which comprises the design of a hybrid deep learning model using convolutional neural networks and long short-term memory networks.

Organizations
Section II-presents a detailed discussion on state-of-the-art approaches along with the comparative analysis of existing works. Section III - discusses the system model and problem formulation. Section IV describes the workflow. Section V discusses the experimental set up. Section VI showcases the ER diagram Section VII describes the ER diagram. Section VII - the SQL code Section IX discusses how to normalize the database in BCNF form Section X showcases various queries related to the database. Section XI has the conclusion of the study.

2 Background

The authors of the work [4] observed the following about the Transmitted Infections among Blood Donors:

- The study conducted in P.D.U. Medical College and Hospital in India in 2013 revealed a higher prevalence of transfusion-transmitted infections (TTIs) among male donors compared to females.
- The seroprevalence of HIV, HBV, HCV, Syphilis, and Malaria was determined, with rates varying between 0.037 percent to 0.95 percent.
- The need for preventive strategies, including education, awareness, voluntary donations, and mandatory screening of donors, was emphasized to combat the risk of TTI transmission through blood transfusion.

The researchers in the study [2] observed the following,

- Decreasing Trend: Seroprevalence of HIV, HBV, and HCV showed a decreasing trend.
- Donor Discrepancy: Voluntary donors had lower infection rates compared to replacement donors.
- Recommendation: Strengthening healthy voluntary donor recruitment strategies is crucial for preventing transfusion-transmitted diseases.

Moreover, the paper [9] concluded that

- Support the encouragement of voluntary blood donation without financial compensation.
- Enhance screening methods to improve detection of infections.
- Establish a robust and quality blood bank system to ensure transfusion safety.

The authors of the study [6] concluded that

- The study analyzed 6939 blood donors, with 1.35 percent testing positive for transfusion-transmitted infection (TTI) sero-markers.
- Hepatitis B had the highest prevalence among the TTIs identified.
- Sero-prevalence of TTIs increased over the study period but decreased from 2004 to 2010.
- The findings emphasize the importance of stringent donor screening and reliable testing protocols to ensure blood transfusion safety.

Sr. No.	Proposed Approach	Year	Short Description	Advantages	Limitations
1.	Blood donor TTI screening	2013	Study on TTI prevalence in blood donors	Identifies prevalence, informs safety measures	Identifies prevalence, informs safety measures
2.	Voluntary blood donation, donor retention strategies, and TTD screening.	2010-2014	Study on seroprevalence of TTD among blood donors.	Reflects prevalence of infections, supports prevention measures.	May not fully represent the general population, under/overestimation possible.
3.	Mandatory screening of infectious markers in blood donors.	2008-2010	Mandatory screening of infectious markers in blood donors.	Provides epidemiological analysis of TTIs in blood donors.	Lack of follow-up for confirmed positive cases.
4.	Promote voluntary blood donation culture.	2010-2011	Prevalence of transfusion-transmitted infections among blood donors in Pakistan.	Increased blood safety, reduced transfusion-transmitted infections.	Resistance to change, resource constraints.
5	Integrated strategy for blood safety	2004-2010	Study on trend and prevalence of transfusion transmitted infections	Identifying status of transfusion transmitted diseases	Lack of resources and decentralised blood transfusion services
6.	Large multi-centered studies involving rural centres in Pakistan.	2020	Systematic review of transfusion-transmissible infections among blood donors in Pakistan.	Provides an overview of the burden of transfusion-transmissible infections.	Relies on data from studies focused on localised geographical locations.
7.	Retrospective study of healthy blood donors.	2013	Estimating prevalence of transfusion transmissible infections.	Provides valuable data on blood donor population.	Relies on historical data, may not reflect current trends.

Figure 1: literature review for existing work.

3 System Model and Problem Formulation

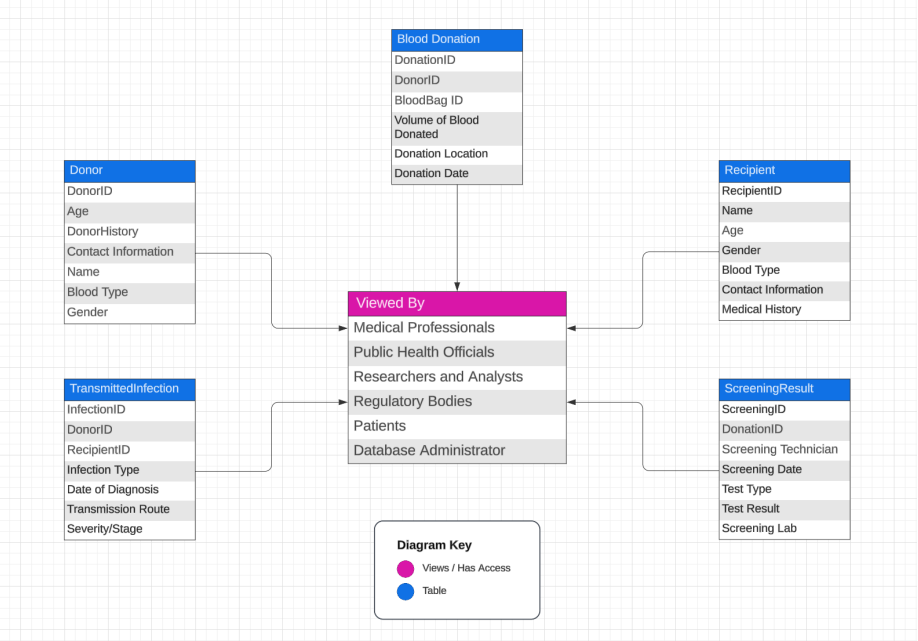

Figure 2: System Model Displaying who will have access to the table.

(a) System Model and Usage Explanation:

Donor Table

Usage:

- **Medical Professionals:** Access donor details and history to assess donor suitability for donation.
- **Patients:** Donors might use it to track their donation history.
- **Database Administrator:** Manages and updates donor records.

Blood Donation Table

Usage:

- **Medical Professionals:** Check donation details for transfusion purposes.
- **Patients:** Donors can monitor their donation records.
- **Database Administrator:** Maintains and updates donation records.

Recipient Table

Usage:

- **Medical Professionals:** Access recipient details to match blood types for transfusions.
- **Patients:** Recipients can view their own records.
- **Database Administrator:** Manages and updates recipient information.

TransmittedInfection Table
Usage:

- **Medical Professionals:** Check for infection history to ensure safe transfusions.
- **Public Health Officials:** Monitor and track infections for public health safety.
- **Database Administrator:** Ensures accuracy and updates infection records.

ScreeningResult Table
Usage:

- **Medical Professionals:** Review screening results to confirm blood safety.
- **Public Health Officials:** Monitor screening results for infection control.
- **Database Administrator:** Manages and updates screening records.

Who Will View the Data:

- **Medical Professionals:** Use all tables to make transfusion decisions, track donor and recipient health, and ensure blood safety.
- **Public Health Officials:** Access TransmittedInfection and ScreeningResult tables to monitor infections and screening outcomes for public safety.
- **Patients:** Donors and recipients might access the Donor and Recipient tables to view their own records, depending on privacy regulations.
- **Database Administrator:** Manages and maintains all tables, ensuring data integrity and system functionality.

(b) Problem Formulation:

Problem Statement
The objective is to analyze transmitted infections among blood donors by leveraging SQL queries, database tables, ER diagrams, and graph visualization techniques. This analysis aims to comprehend the patterns and trends related to infections among donors.

Scope:

- Analyzing patterns and trends in transmitted infections among blood donors.

- Utilizing SQL queries for data retrieval and analysis.
- Designing database tables to store donor and infection data.
- Creating ER diagrams to visualize the relationships between tables.
- Employing graph visualization to represent data patterns.

Relevance and Significance:

- *Public Health Impact:* Ensuring the safety of blood transfusions by understanding infection prevalence and transmission patterns.
- *Data-Driven Decision Making:* Providing actionable insights for public health policies and interventions.
- *Research Gap Addressing:* Filling the need for comprehensive analyses of infection trends.

Assumptions and Constraints:

- Assuming availability of accurate donor and infection data.
- Potential constraints may exist in data collection or access.

4 WorkFlow

Figure 3: Explains the workflow for Blood Transfusion [7]

1. **Collection of Blood From Donor:**

   In this step, blood is collected from the donor, and detailed information about the donor is recorded. The collected blood is then stored in a temporary storage facility for further processing and testing.

2. **Testing and Processing of Blood:**

   Blood bags received from blood donation are tested for various parameters to ensure their safety and quality. After testing, the blood is processed to separate it into different components, including Platelets, White Blood Cells (WBC), Red Blood Cells (RBC), and Plasma.

3. **Storage of Whole Blood and Components:**

   Following the testing and processing stage, approved blood bags and their components are transferred to a specialized storage facility. This ensures that the blood remains viable and safe for transfusion when needed.

4. **Cross-Matching of Blood for Transfusion to Patient:**

   Blood is retrieved from the storage facility for transfusion to the patient. Before transfusion, a cross-matching test is performed to ensure compatibility between the donor's blood and the patient's blood type. Once a successful match is confirmed, the blood is prepared for transfusion to the patient.

5 Experimental Setup

Hardware and Software:

The experimental database environment was set up on a system running Windows 11 Home Edition. The database management system used for this study was Oracle Database 11g Express Edition Release 11.2.0.2.0 - 64bit Production.

- **Operating System:** Windows 11 Home Edition
- **Database Management System:** Oracle Database 11g Express Edition (Oracle XE) Release 11.2.0.2.0 - 64bit Production
- **Hardware Specifications:**
  - **RAM:** 16 GB RAM
  - **CPU:** Intel i7-11800H (8 cores)
  - **GPU:** NVIDIA GeForce RTX 3060
  - **DISK:** SAMSUNG 1 TB

6 E-R diagram

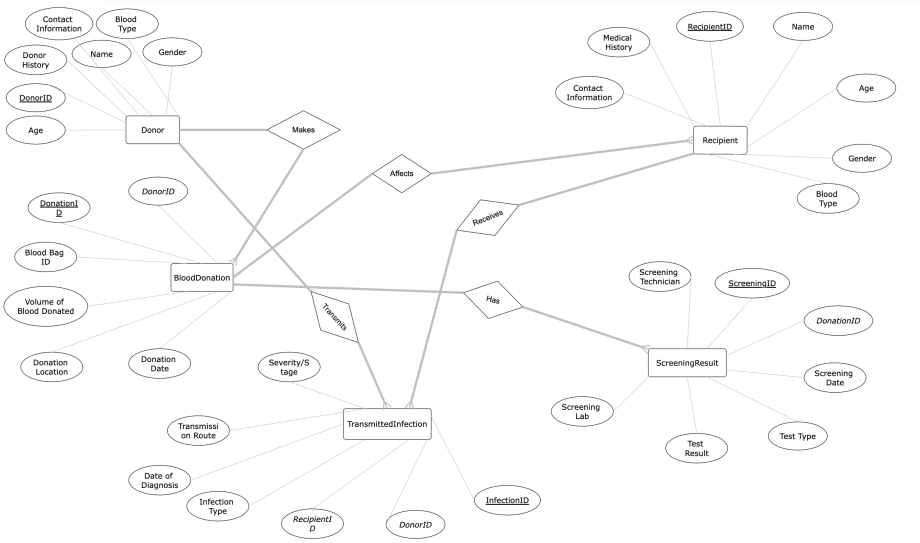

Figure 4: E-R Diagram for DBMS

7 ER Diagram Description

7.1 Entities

- **Donor**
  - **Attributes:**
    - DonorID (Primary Key)
    - Name
    - Age
    - Gender
    - Blood Type
    - Contact Information
    - Donor History
- **BloodDonation**
  - **Attributes:**

        * DonationID (Primary Key)
        * DonorID (Foreign Key)
        * Donation Date
        * Donation Location
        * Volume of Blood Donated
        * Blood Bag ID

- **ScreeningResults**
    - **Attributes:**
        * ScreeningID (Primary Key)
        * DonationID (Foreign Key)
        * Screening Date
        * Test Type
        * Test Result
        * Screening Lab
        * Screening Technician

- **TransmittedInfections**
    - **Attributes:**
        * InfectionID (Primary Key)
        * DonorID (Foreign Key)
        * RecipientID (Foreign Key)
        * Infection Type
        * Date of Diagnosis
        * Transmission Route
        * Severity/Stage

- **Recipient**
    - **Attributes:**

* RecipientID (Primary Key)
* Name
* Age
* Gender
* Blood Type
* Contact Information
* Medical History

7.2 Relationships

- **Donor to BloodDonation:** One-to-Many (One donor can have multiple donations)
- **BloodDonation to ScreeningResults:** One-to-Many (One donation can have multiple screening results)
- **Donor to TransmittedInfections:** One-to-Many (One donor can have multiple transmitted infections)
- **Recipient to TransmittedInfections:** One-to-Many (One recipient can have multiple infections)

8 SQL code

```
CREATE TABLE Donor (
    DonorID NUMBER PRIMARY KEY,
    Name VARCHAR2(50),
    Age NUMBER,
    Gender CHAR(1),
    BloodType VARCHAR2(5),
    ContactInformation VARCHAR2(20),
    DonorHistory VARCHAR2(100)
);

INSERT INTO Donor VALUES (1, 'John␣Doe', 25, 'M', 'O+', '
    123-456-7890', 'No␣previous␣donations');
INSERT INTO Donor VALUES (2, 'Jane␣Smith', 30, 'F', 'A-', '
    987-654-3210', 'Regular␣donor');
INSERT INTO Donor VALUES (3, 'Robert␣Brown', 40, 'M', 'B+',
    '555-555-5555', 'Medical␣history␣of␣hepatitis');
INSERT INTO Donor VALUES (4, 'Lisa␣Johnson', 35, 'F', 'AB-',
     '111-222-3333', 'Regular␣donor');
INSERT INTO Donor VALUES (5, 'Michael␣Williams', 28, 'M', 'O
    -', '444-444-4444', 'No␣previous␣donations');
```

```
INSERT INTO Donor VALUES (6, 'Susan␣Taylor', 50, 'F', 'A+',
    '666-666-6666', 'Regular␣donor');
INSERT INTO Donor VALUES (7, 'William␣Clark', 45, 'M', 'O+',
     '777-777-7777', 'No␣previous␣donations');
INSERT INTO Donor VALUES (8, 'Sophia␣Anderson', 33, 'F', 'B-
    ', '888-888-8888', 'Regular␣donor');
INSERT INTO Donor VALUES (9, 'David␣Wilson', 38, 'M', 'A-',
    '999-999-9999', 'Medical␣history␣of␣HIV');
INSERT INTO Donor VALUES (10, 'Emily␣Thomas', 29, 'F', 'AB+'
    , '101-010-1010', 'Regular␣donor');
INSERT INTO Donor VALUES (11, 'James␣Brown', 42, 'M', 'B+',
    '202-020-2020', 'No␣previous␣donations');
INSERT INTO Donor VALUES (12, 'Sarah␣Davis', 27, 'F', 'A-',
    '303-030-3030', 'Regular␣donor');
INSERT INTO Donor VALUES (13, 'Paul␣Johnson', 35, 'M', 'O-',
     '404-040-4040', 'No␣previous␣donations');
INSERT INTO Donor VALUES (14, 'Linda␣Smith', 32, 'F', 'B+',
    '505-050-5050', 'Regular␣donor');
INSERT INTO Donor VALUES (15, 'Richard␣Wilson', 40, 'M', 'A-
    ', '606-060-6060', 'Medical␣history␣of␣hepatitis');
INSERT INTO Donor VALUES (16, 'Karen␣Williams', 29, 'F', 'O+
    ', '707-070-7070', 'Regular␣donor');
INSERT INTO Donor VALUES (17, 'George␣Taylor', 48, 'M', 'B-'
    , '808-080-8080', 'Regular␣donor');
INSERT INTO Donor VALUES (18, 'Amanda␣Clark', 31, 'F', 'AB+'
    , '909-090-9090', 'No␣previous␣donations');
INSERT INTO Donor VALUES (19, 'Steven␣Anderson', 37, 'M', 'O
    +', '121-212-1212', 'Regular␣donor');
INSERT INTO Donor VALUES (20, 'Michelle␣Brown', 26, 'F', 'B-
    ', '131-313-1313', 'Medical␣history␣of␣HIV');
INSERT INTO Donor VALUES (21, 'Daniel␣Davis', 44, 'M', 'A-',
     '141-414-1414', 'Regular␣donor');
INSERT INTO Donor VALUES (22, 'Carol␣Johnson', 34, 'F', 'O+'
    , '151-515-1515', 'No␣previous␣donations');
INSERT INTO Donor VALUES (23, 'Edward␣Williams', 39, 'M', '
    AB+', '161-616-1616', 'Regular␣donor');
INSERT INTO Donor VALUES (24, 'Laura␣Wilson', 28, 'F', 'B-',
     '171-717-1717', 'No␣previous␣donations');
INSERT INTO Donor VALUES (25, 'Joseph␣Taylor', 47, 'M', 'O-'
    , '181-818-1818', 'Regular␣donor');
INSERT INTO Donor VALUES (26, 'Patricia␣Clark', 36, 'F', 'B+
    ', '191-919-1919', 'Regular␣donor');
INSERT INTO Donor VALUES (27, 'Charles␣Brown', 43, 'M', 'A-'
    , '202-020-2020', 'Medical␣history␣of␣hepatitis');
INSERT INTO Donor VALUES (28, 'Donna␣Smith', 33, 'F', 'O+',
    '212-121-2121', 'Regular␣donor');
INSERT INTO Donor VALUES (29, 'Thomas␣Anderson', 49, 'M', 'B
    -', '222-222-2222', 'No␣previous␣donations');
INSERT INTO Donor VALUES (30, 'Mary␣Johnson', 30, 'F', 'AB+'
    , '232-323-2323', 'Regular␣donor');
```

```
INSERT INTO Donor VALUES (31, 'Rushi␣Patel', 32, 'M', 'B+',
    '252-323-2323', 'Regular␣donor');
INSERT INTO Donor VALUES (32, 'Viya␣Shah', 39, 'F', 'B+', '
    232-323-2353', 'Regular␣donor');
INSERT INTO Donor VALUES (33, 'Siddh␣Shah', 36, 'M', 'B+', '
    232-323-2123', 'Regular␣donor');
INSERT INTO Donor VALUES (34, 'Yashvi␣Shah', 20, 'F', 'B+',
    '232-323-4323', 'Regular␣donor');
INSERT INTO Donor VALUES (35, 'Devansh␣Shah', 23, 'M', 'B+',
     '232-323-7323', 'Regular␣donor');
INSERT INTO Donor VALUES (36, 'Roshni␣Rana', 26, 'F', 'B+',
    '232-323-2923', 'Regular␣donor');
INSERT INTO Donor VALUES (37, 'Aarya␣Patel', 20, 'F', 'B+',
    '232-323-2023', 'Regular␣donor');
INSERT INTO Donor VALUES (38, 'Khushi␣Patel', 18, 'F', 'B+',
     '232-323-2563', 'Regular␣donor');


CREATE TABLE BloodDonation (
    DonationID NUMBER PRIMARY KEY,
    DonorID NUMBER,
    DonationDate DATE,
    DonationLocation VARCHAR2(50),
    VolumeOfBloodDonated NUMBER,
    BloodBagID VARCHAR2(10),
    FOREIGN KEY (DonorID) REFERENCES Donor(DonorID)
);

INSERT INTO BloodDonation VALUES (1, 1, TO_DATE('2023-01-10'
    , 'YYYY-MM-DD'), 'City␣Hospital', 450, 'DB-001');
INSERT INTO BloodDonation VALUES (2, 1, TO_DATE('2023-01-20'
    , 'YYYY-MM-DD'), 'City␣Hospital', 450, 'DB-002');
INSERT INTO BloodDonation VALUES (3, 2, TO_DATE('2023-02-05'
    , 'YYYY-MM-DD'), 'City␣Hospital', 450, 'DB-003');
INSERT INTO BloodDonation VALUES (4, 3, TO_DATE('2023-02-12'
    , 'YYYY-MM-DD'), 'Community␣Center', 500, 'DB-004');
INSERT INTO BloodDonation VALUES (5, 4, TO_DATE('2023-03-01'
    , 'YYYY-MM-DD'), 'City␣Hospital', 400, 'DB-005');
INSERT INTO BloodDonation VALUES (6, 5, TO_DATE('2023-03-10'
    , 'YYYY-MM-DD'), 'City␣Hospital', 400, 'DB-006');
INSERT INTO BloodDonation VALUES (7, 6, TO_DATE('2023-04-10'
    , 'YYYY-MM-DD'), 'Red␣Cross␣Center', 550, 'DB-007');
INSERT INTO BloodDonation VALUES (8, 7, TO_DATE('2023-04-20'
    , 'YYYY-MM-DD'), 'Red␣Cross␣Center', 550, 'DB-008');
INSERT INTO BloodDonation VALUES (9, 8, TO_DATE('2023-05-01'
    , 'YYYY-MM-DD'), 'Red␣Cross␣Center', 550, 'DB-009');
INSERT INTO BloodDonation VALUES (10, 9, TO_DATE('2023-05-15
    ', 'YYYY-MM-DD'), 'Community␣Center', 500, 'DB-010');
INSERT INTO BloodDonation VALUES (11, 10, TO_DATE('
    2023-06-10', 'YYYY-MM-DD'), 'Red␣Cross␣Center', 480, 'DB
```

```
    -011');
INSERT INTO BloodDonation VALUES (12, 11, TO_DATE('
    2023-07-01', 'YYYY-MM-DD'), 'City␣Hospital', 420, 'DB-012
    ');
INSERT INTO BloodDonation VALUES (13, 12, TO_DATE('
    2023-07-10', 'YYYY-MM-DD'), 'City␣Hospital', 420, 'DB-013
    ');
INSERT INTO BloodDonation VALUES (14, 13, TO_DATE('
    2023-08-01', 'YYYY-MM-DD'), 'Community␣Center', 490, 'DB
    -014');
INSERT INTO BloodDonation VALUES (15, 14, TO_DATE('
    2023-09-01', 'YYYY-MM-DD'), 'Red␣Cross␣Center', 460, 'DB
    -015');
INSERT INTO BloodDonation VALUES (16, 15, TO_DATE('
    2023-10-10', 'YYYY-MM-DD'), 'City␣Hospital', 510, 'DB-016
    ');
INSERT INTO BloodDonation VALUES (17, 16, TO_DATE('
    2023-11-01', 'YYYY-MM-DD'), 'Community␣Center', 470, 'DB
    -017');
INSERT INTO BloodDonation VALUES (18, 17, TO_DATE('
    2023-11-10', 'YYYY-MM-DD'), 'Community␣Center', 470, 'DB
    -018');
INSERT INTO BloodDonation VALUES (19, 18, TO_DATE('
    2023-12-05', 'YYYY-MM-DD'), 'Red␣Cross␣Center', 440, 'DB
    -019');
INSERT INTO BloodDonation VALUES (20, 19, TO_DATE('
    2023-12-15', 'YYYY-MM-DD'), 'Red␣Cross␣Center', 440, 'DB
    -020');
INSERT INTO BloodDonation VALUES (21, 20, TO_DATE('
    2023-01-05', 'YYYY-MM-DD'), 'City␣Hospital', 430, 'DB-021
    ');
INSERT INTO BloodDonation VALUES (22, 21, TO_DATE('
    2023-02-10', 'YYYY-MM-DD'), 'Community␣Center', 520, 'DB
    -022');
INSERT INTO BloodDonation VALUES (23, 22, TO_DATE('
    2023-03-20', 'YYYY-MM-DD'), 'Red␣Cross␣Center', 490, 'DB
    -023');
INSERT INTO BloodDonation VALUES (24, 23, TO_DATE('
    2023-04-01', 'YYYY-MM-DD'), 'City␣Hospital', 450, 'DB-024
    ');
INSERT INTO BloodDonation VALUES (25, 24, TO_DATE('
    2023-05-20', 'YYYY-MM-DD'), 'Community␣Center', 500, 'DB
    -025');
INSERT INTO BloodDonation VALUES (26, 25, TO_DATE('
    2023-06-01', 'YYYY-MM-DD'), 'Red␣Cross␣Center', 480, 'DB
    -026');
INSERT INTO BloodDonation VALUES (27, 26, TO_DATE('
    2023-06-10', 'YYYY-MM-DD'), 'Red␣Cross␣Center', 480, 'DB
    -027');
```

```
INSERT INTO BloodDonation VALUES (28, 27, TO_DATE('
    2023-07-01', 'YYYY-MM-DD'), 'City␣Hospital', 460, 'DB-028
    ');
INSERT INTO BloodDonation VALUES (29, 28, TO_DATE('
    2023-08-10', 'YYYY-MM-DD'), 'Community␣Center', 530, 'DB
    -029');
INSERT INTO BloodDonation VALUES (30, 29, TO_DATE('
    2023-08-20', 'YYYY-MM-DD'), 'Community␣Center', 530, 'DB
    -030');
INSERT INTO BloodDonation VALUES (31, 31, TO_DATE('
    2023-01-10', 'YYYY-MM-DD'), 'Community␣Center', 530, 'DB
    -031');
INSERT INTO BloodDonation VALUES (32, 32, TO_DATE('
    2023-02-10', 'YYYY-MM-DD'), 'Red␣Cross␣Center', 530, 'DB
    -032');
INSERT INTO BloodDonation VALUES (33, 33, TO_DATE('
    2023-02-10', 'YYYY-MM-DD'), 'Community␣Center', 530, 'DB
    -033');
INSERT INTO BloodDonation VALUES (34, 34, TO_DATE('
    2023-02-10', 'YYYY-MM-DD'), 'Community␣Center', 530, 'DB
    -034');
INSERT INTO BloodDonation VALUES (35, 35, TO_DATE('
    2023-04-10', 'YYYY-MM-DD'), 'Community␣Center', 530, 'DB
    -035');
INSERT INTO BloodDonation VALUES (36, 36, TO_DATE('
    2023-04-10', 'YYYY-MM-DD'), 'Red␣Cross␣Center', 530, 'DB
    -036');
INSERT INTO BloodDonation VALUES (37, 37, TO_DATE('
    2023-06-10', 'YYYY-MM-DD'), 'Red␣Cross␣Center', 530, 'DB
    -037');
INSERT INTO BloodDonation VALUES (38, 38, TO_DATE('
    2023-07-10', 'YYYY-MM-DD'), 'Red␣Cross␣Center', 530, 'DB
    -038');
INSERT INTO BloodDonation VALUES (39, 38, TO_DATE('
    2023-08-10', 'YYYY-MM-DD'), 'Community␣Center', 530, 'DB
    -039');
INSERT INTO BloodDonation VALUES (40, 38, TO_DATE('
    2023-08-10', 'YYYY-MM-DD'), 'City␣Hospital', 530, 'DB-040
    ');
INSERT INTO BloodDonation VALUES (41, 38, TO_DATE('
    2023-08-10', 'YYYY-MM-DD'), 'City␣Hospital', 530, 'DB-041
    ');
INSERT INTO BloodDonation VALUES (42, 38, TO_DATE('
    2023-10-10', 'YYYY-MM-DD'), 'City␣Hospital', 530, 'DB-042
    ');


CREATE TABLE ScreeningResults (
    ScreeningID NUMBER PRIMARY KEY,
    DonationID NUMBER,
```

```
    ScreeningDate DATE,
    TestType VARCHAR2(10),
    TestResult VARCHAR2(10),
    ScreeningLab VARCHAR2(50),
    ScreeningTechnician VARCHAR2(50),
    FOREIGN KEY (DonationID) REFERENCES BloodDonation(
        DonationID)
);

INSERT INTO ScreeningResults VALUES (1, 1, TO_DATE('
    2023-01-15', 'YYYY-MM-DD'), 'HIV', 'Negative', 'City␣Lab'
    , 'Dr.␣Anderson');
INSERT INTO ScreeningResults VALUES (2, 2, TO_DATE('
    2023-01-25', 'YYYY-MM-DD'), 'HBV', 'Negative', 'City␣Lab'
    , 'Dr.␣Anderson');
INSERT INTO ScreeningResults VALUES (3, 3, TO_DATE('
    2023-02-10', 'YYYY-MM-DD'), 'HIV', 'Negative', 'Community
    ␣Lab', 'Dr.␣Baker');
INSERT INTO ScreeningResults VALUES (4, 4, TO_DATE('
    2023-02-15', 'YYYY-MM-DD'), 'HCV', 'Negative', 'Community
    ␣Lab', 'Dr.␣Baker');
INSERT INTO ScreeningResults VALUES (5, 5, TO_DATE('
    2023-03-05', 'YYYY-MM-DD'), 'HIV', 'Negative', 'City␣Lab'
    , 'Dr.␣Clark');
INSERT INTO ScreeningResults VALUES (6, 6, TO_DATE('
    2023-03-20', 'YYYY-MM-DD'), 'HBV', 'Positive', 'City␣Lab'
    , 'Dr.␣Clark');
INSERT INTO ScreeningResults VALUES (7, 7, TO_DATE('
    2023-04-15', 'YYYY-MM-DD'), 'HIV', 'Positive', 'Red␣Cross
    ␣Lab', 'Dr.␣Davis');
INSERT INTO ScreeningResults VALUES (8, 8, TO_DATE('
    2023-04-25', 'YYYY-MM-DD'), 'HCV', 'Negative', 'Red␣Cross
    ␣Lab', 'Dr.␣Davis');
INSERT INTO ScreeningResults VALUES (9, 9, TO_DATE('
    2023-05-05', 'YYYY-MM-DD'), 'HIV', 'Negative', 'Community
    ␣Lab', 'Dr.␣Evans');
INSERT INTO ScreeningResults VALUES (10, 10, TO_DATE('
    2023-05-20', 'YYYY-MM-DD'), 'HBV', 'Negative', 'Community
    ␣Lab', 'Dr.␣Evans');
INSERT INTO ScreeningResults VALUES (11, 11, TO_DATE('
    2023-06-15', 'YYYY-MM-DD'), 'HIV', 'Negative', 'Red␣Cross
    ␣Lab', 'Dr.␣Fisher');
INSERT INTO ScreeningResults VALUES (12, 12, TO_DATE('
    2023-06-30', 'YYYY-MM-DD'), 'HBV', 'Positive', 'Red␣Cross
    ␣Lab', 'Dr.␣Fisher');
INSERT INTO ScreeningResults VALUES (13, 13, TO_DATE('
    2023-07-20', 'YYYY-MM-DD'), 'HIV', 'Positive', 'City␣Lab'
    , 'Dr.␣Grant');
INSERT INTO ScreeningResults VALUES (14, 14, TO_DATE('
    2023-07-30', 'YYYY-MM-DD'), 'HCV', 'Negative', 'City␣Lab'
```

```
    , 'Dr. Grant');
INSERT INTO ScreeningResults VALUES (15, 15, TO_DATE('
    2023-08-15', 'YYYY-MM-DD'), 'HIV', 'Negative', 'Community
    Lab', 'Dr. Harris');
INSERT INTO ScreeningResults VALUES (16, 16, TO_DATE('
    2023-08-30', 'YYYY-MM-DD'), 'HBV', 'Negative', 'Community
    Lab', 'Dr. Harris');
INSERT INTO ScreeningResults VALUES (17, 17, TO_DATE('
    2023-09-20', 'YYYY-MM-DD'), 'HIV', 'Positive', 'Red Cross
    Lab', 'Dr. Irving');
INSERT INTO ScreeningResults VALUES (18, 18, TO_DATE('
    2023-09-30', 'YYYY-MM-DD'), 'HCV', 'Positive', 'Red Cross
    Lab', 'Dr. Irving');
INSERT INTO ScreeningResults VALUES (19, 19, TO_DATE('
    2023-10-25', 'YYYY-MM-DD'), 'HIV', 'Negative', 'City Lab'
    , 'Dr. Johnson');
INSERT INTO ScreeningResults VALUES (20, 20, TO_DATE('
    2023-11-05', 'YYYY-MM-DD'), 'HBV', 'Negative', 'City Lab'
    , 'Dr. Johnson');
INSERT INTO ScreeningResults VALUES (21, 21, TO_DATE('
    2023-11-20', 'YYYY-MM-DD'), 'HIV', 'Negative', 'Community
    Lab', 'Dr. King');
INSERT INTO ScreeningResults VALUES (22, 22, TO_DATE('
    2023-12-05', 'YYYY-MM-DD'), 'HBV', 'Positive', 'Community
    Lab', 'Dr. King');
INSERT INTO ScreeningResults VALUES (23, 23, TO_DATE('
    2023-12-20', 'YYYY-MM-DD'), 'HIV', 'Positive', 'Red Cross
    Lab', 'Dr. Lewis');
INSERT INTO ScreeningResults VALUES (24, 24, TO_DATE('
    2023-12-30', 'YYYY-MM-DD'), 'HCV', 'Positive', 'Red Cross
    Lab', 'Dr. Lewis');
INSERT INTO ScreeningResults VALUES (25, 25, TO_DATE('
    2023-01-10', 'YYYY-MM-DD'), 'HIV', 'Negative', 'City Lab'
    , 'Dr. Martin');
INSERT INTO ScreeningResults VALUES (26, 26, TO_DATE('
    2023-01-25', 'YYYY-MM-DD'), 'HBV', 'Negative', 'City Lab'
    , 'Dr. Martin');
INSERT INTO ScreeningResults VALUES (27, 27, TO_DATE('
    2023-02-10', 'YYYY-MM-DD'), 'HIV', 'Negative', 'Community
    Lab', 'Dr. Nelson');
INSERT INTO ScreeningResults VALUES (28, 28, TO_DATE('
    2023-02-25', 'YYYY-MM-DD'), 'HCV', 'Positive', 'Community
    Lab', 'Dr. Nelson');
INSERT INTO ScreeningResults VALUES (29, 29, TO_DATE('
    2023-03-10', 'YYYY-MM-DD'), 'HIV', 'Negative', 'Red Cross
    Lab', 'Dr. Owen');
INSERT INTO ScreeningResults VALUES (30, 30, TO_DATE('
    2023-03-25', 'YYYY-MM-DD'), 'HBV', 'Positive', 'Red Cross
    Lab', 'Dr. Owen');
```

```
INSERT INTO ScreeningResults VALUES (31, 31, TO_DATE('
    2023-01-15', 'YYYY-MM-DD'), 'HBV', 'Positive', 'Community
    ␣Lab', 'Dr.␣Nelson');
INSERT INTO ScreeningResults VALUES (32, 32, TO_DATE('
    2023-02-15', 'YYYY-MM-DD'), 'HBV', 'Positive', 'Red␣Cross
    ␣Lab', 'Dr.␣Owen');
INSERT INTO ScreeningResults VALUES (33, 33, TO_DATE('
    2023-02-15', 'YYYY-MM-DD'), 'HBV', 'Negative', 'Community
    ␣Lab', 'Dr.␣Nelson');
INSERT INTO ScreeningResults VALUES (34, 34, TO_DATE('
    2023-02-15', 'YYYY-MM-DD'), 'HBV', 'Negative', 'Community
    ␣Lab', 'Dr.␣Nelson');
INSERT INTO ScreeningResults VALUES (35, 35, TO_DATE('
    2023-04-15', 'YYYY-MM-DD'), 'HBV', 'Negative', 'Community
    ␣Lab', 'Dr.␣Nelson');
INSERT INTO ScreeningResults VALUES (36, 36, TO_DATE('
    2023-04-15', 'YYYY-MM-DD'), 'HBV', 'Negative', 'Red␣Cross
    ␣Lab', 'Dr.␣Owen');
INSERT INTO ScreeningResults VALUES (37, 37, TO_DATE('
    2023-06-15', 'YYYY-MM-DD'), 'HBV', 'Negative', 'Red␣Cross
    ␣Lab', 'Dr.␣Owen');
INSERT INTO ScreeningResults VALUES (38, 38, TO_DATE('
    2023-07-15', 'YYYY-MM-DD'), 'HBV', 'Negative', 'Red␣Cross
    ␣Lab', 'Dr.␣Owen');
INSERT INTO ScreeningResults VALUES (39, 39, TO_DATE('
    2023-08-15', 'YYYY-MM-DD'), 'HBV', 'Positive', 'Community
    ␣Lab', 'Dr.␣Nelson');
INSERT INTO ScreeningResults VALUES (40, 40, TO_DATE('
    2023-08-15', 'YYYY-MM-DD'), 'HBV', 'Positive', 'City␣Lab'
    ,  'Dr.␣Johnson');
INSERT INTO ScreeningResults VALUES (41, 41, TO_DATE('
    2023-08-15', 'YYYY-MM-DD'), 'HBV', 'Negative', 'City␣Lab'
    ,  'Dr.␣Johnson');
INSERT INTO ScreeningResults VALUES (42, 42, TO_DATE('
    2023-10-15', 'YYYY-MM-DD'), 'HBV', 'Positive', 'City␣Lab'
    ,  'Dr.␣Johnson');

CREATE TABLE Recipient (
    RecipientID NUMBER PRIMARY KEY,
    Name VARCHAR2(50),
    Age NUMBER,
    Gender CHAR(1),
    BloodType VARCHAR2(5),
    ContactInformation VARCHAR2(20),
    MedicalHistory VARCHAR2(100)
);

INSERT INTO Recipient VALUES (1001, 'Emily␣White', 32, 'F',
    'O+', '555-123-4567', 'No␣previous␣transfusions');
```

```
INSERT INTO Recipient VALUES (1002, 'William␣Green', 45, 'M'
    , 'A-', '123-987-6543', 'Recent␣surgery');
INSERT INTO Recipient VALUES (1003, 'Sophia␣Brown', 50, 'F',
     'B+', '999-888-7777', 'No␣previous␣transfusions');
INSERT INTO Recipient VALUES (1004, 'James␣Clark', 40, 'M',
    'O-', '111-222-3333', 'Regular␣transfusions');
INSERT INTO Recipient VALUES (1005, 'Olivia␣Davis', 28, 'F',
     'A+', '444-555-6666', 'Medical␣history␣of␣anemia');
INSERT INTO Recipient VALUES (1006, 'Emma␣Wilson', 35, 'F',
    'B-', '777-888-9999', 'No␣previous␣transfusions');
INSERT INTO Recipient VALUES (1007, 'Luke␣Taylor', 42, 'M',
    'O+', '111-222-3333', 'Regular␣transfusions');
INSERT INTO Recipient VALUES (1008, 'Anna␣Smith', 39, 'F', '
    AB+', '444-555-6666', 'Medical␣history␣of␣hepatitis');
INSERT INTO Recipient VALUES (1009, 'Ethan␣Johnson', 33, 'M'
    , 'A-', '777-888-9999', 'No␣previous␣transfusions');
INSERT INTO Recipient VALUES (1010, 'Grace␣Williams', 36, 'F
    ', 'O-', '111-222-3333', 'Regular␣transfusions');

CREATE TABLE TransmittedInfections (
    InfectionID NUMBER PRIMARY KEY,
    DonorID NUMBER,
    RecipientID NUMBER,
    InfectionType VARCHAR2(10),
    DateOfDiagnosis DATE,
    TransmissionRoute VARCHAR2(50),
    SeverityStage VARCHAR2(20),
    FOREIGN KEY (DonorID) REFERENCES Donor(DonorID),
    FOREIGN KEY (RecipientID) REFERENCES Recipient(
        RecipientID)
);

INSERT INTO TransmittedInfections VALUES (1, 3, 1001, 'HIV',
     TO_DATE('2023-03-20', 'YYYY-MM-DD'), 'Unknown', 'Early')
    ;
INSERT INTO TransmittedInfections VALUES (2, 4, 1002, 'HBV',
     TO_DATE('2023-05-05', 'YYYY-MM-DD'), 'Blood␣transfusion'
    , 'Chronic');
INSERT INTO TransmittedInfections VALUES (3, 6, 1003, 'HIV',
     TO_DATE('2023-04-10', 'YYYY-MM-DD'), 'Unknown', '
    Asymptomatic');
INSERT INTO TransmittedInfections VALUES (4, 5, 1004, 'HCV',
     TO_DATE('2023-06-15', 'YYYY-MM-DD'), 'Unknown', 'Chronic
    ');
INSERT INTO TransmittedInfections VALUES (5, 2, 1005, 'HIV',
     TO_DATE('2023-02-25', 'YYYY-MM-DD'), 'Unknown', 'Early')
    ;
INSERT INTO TransmittedInfections VALUES (6, 10, 1006, 'HBV'
    , TO_DATE('2023-07-10', 'YYYY-MM-DD'), 'Blood␣transfusion
    ', 'Chronic');
```

```
INSERT INTO TransmittedInfections VALUES (7, 15, 1007, 'HIV'
    , TO_DATE('2023-09-05', 'YYYY-MM-DD'), 'Unknown', 'Early'
    );
INSERT INTO TransmittedInfections VALUES (8, 20, 1008, 'HCV'
    , TO_DATE('2023-02-20', 'YYYY-MM-DD'), 'Blood transfusion
    ', 'Chronic');
INSERT INTO TransmittedInfections VALUES (9, 25, 1009, 'HBV'
    , TO_DATE('2023-01-15', 'YYYY-MM-DD'), 'Unknown', '
    Chronic');
INSERT INTO TransmittedInfections VALUES (10, 30, 1010, 'HIV
    ', TO_DATE('2023-03-30', 'YYYY-MM-DD'), 'Unknown', 'Early
    ');
```

9 BCNF Form Normalization

Functional Dependencies for each table:

- **BloodDonation**
  - DonationID → DonorID
  - Blood Bag ID → DonationID
  - (DonationID, Donation Date) → Donation Location
- **ScreeningResults**
  - DonationID → ScreeningID SCREENING TESTTYPE TESTRESULT SCREENINGLAB SCREENING TECHNICIAN
  - ScreeingID → DonationID SCREENING TESTTYPE TESTRESULT SCREENINGLAB SCREENING TECHNICIAN
- **Donor**
  - DonorID → Name, Age, Gender, Blood Type, Contact Information, Donor History
- **Recipient**
  - RecipientID → Name, Age, Gender, Blood Type, Contact Information, Medical History
- **TransmittedInfections**
  - (RecipientID) → InfectionID, Infection Type,DonorID, Date of Diagnosis, Transmission Route, Severity/Stage
  - (DonorID) → InfectionID, Infection Type,RecipientID, Date of Diagnosis, Transmission Route, Severity/Stage
  - (InfectionID) → DonorID, RecipientID, Infection Type, Date of Diagnosis, Transmission Route, Severity/Stage

BCNF Check

- **BloodDonation**
  - No non-prime attributes are dependent on proper subsets of candidate keys.
- **ScreeningResults**

- No non-prime attributes are dependent on proper subsets of candidate keys.

- **Donor**

  - No non-prime attributes are dependent on proper subsets of candidate keys.

- **Recipient**

  - No non-prime attributes are dependent on proper subsets of candidate keys.

- **TransmittedInfections**

  - No non-prime attributes are dependent on proper subsets of candidate keys.

Conclusion

All tables appear to be in BCNF as there are no non-trivial functional dependencies where the determinant (X) is not a superkey.

10 Queries

10.1 Total Number of Donations per Month

```
SQL> SELECT COUNT(DonationID) AS No_of_Donations, TO_CHAR(DonationDate, 'MM') AS Month
  2  FROM BloodDonation
  3  GROUP BY TO_CHAR(DonationDate, 'MM')
  4  ORDER BY TO_CHAR(DonationDate, 'MM') ASC;

NO_OF_DONATIONS MO
--------------- --
              4 01
              6 02
              3 03
              5 04
              3 05
              4 06
              4 07
              6 08
              1 09
              2 10
              2 11

NO_OF_DONATIONS MO
--------------- --
              3 12

12 rows selected.
```

Figure 5: Total Number of Donations Per Month

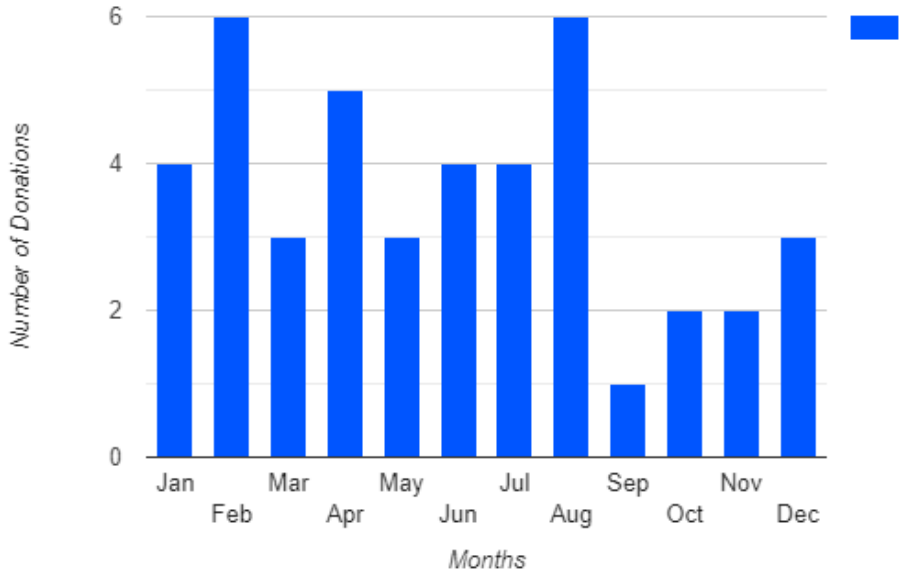

Figure 6: Total Number of Donations Per Month (Detail)

As shown in Figure 6, there are maximum donations in February and August and the least in September.

10.2 Total Volume of Blood Donated per Month

```
SQL> SELECT SUM(VolumeOfBloodDonated) AS Total_Volume, TO_CHAR(DonationDate, 'MM') AS Month
  2  FROM BloodDonation
  3  GROUP BY TO_CHAR(DonationDate, 'MM')
  4  ORDER BY TO_CHAR(DonationDate, 'MM') ASC;

TOTAL_VOLUME MO
------------ --
        1860 01
        3060 02
        1290 03
        2610 04
        1550 05
        1970 06
        1830 07
        3140 08
         460 09
        1040 10
         940 11

TOTAL_VOLUME MO
------------ --
         880 12

12 rows selected.
```

Figure 7: Total Volume of Blood Donated per Month

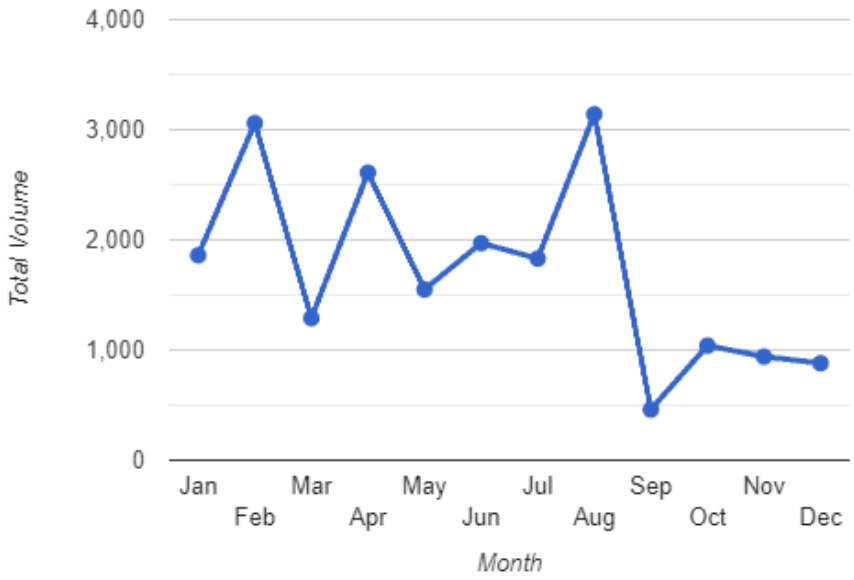

Figure 8: Total Volume of Blood Donated per Month (Detail)

The volume donated correlates with the data from Figure 6, with maximum volume in February and August.

10.3 Average Age of Donors per Month

```
SQL> SELECT AVG(Age) AS Average_Age, TO_CHAR(DonationDate, 'MM') AS Month
  2  FROM Donor
  3  JOIN BloodDonation ON Donor.DonorID = BloodDonation.DonorID
  4  GROUP BY TO_CHAR(DonationDate, 'MM')
  5  ORDER BY TO_CHAR(DonationDate, 'MM') ASC;

AVERAGE_AGE MO
----------- --
         27 01
 34.8333333 02
 32.3333333 03
       36.6 04
         33 05
         33 06
       32.5 07
       28.5 08
         32 09
         29 10
       38.5 11

AVERAGE_AGE MO
----------- --
         34 12

12 rows selected.
```

Figure 9: Average Age of Donors per Month

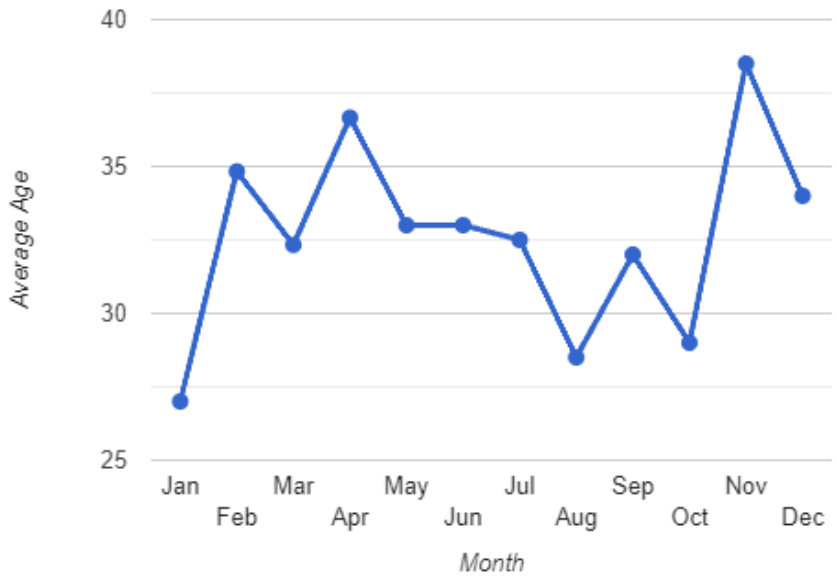

Figure 10: Average Age of Donors per Month (Detail)

The average age ranges from the high 20s to high 40s, with most donors around 32-33 years old (Figure 10).

10.4 Distribution of Blood Types among Donors

```
SQL> SELECT BloodType, COUNT(*) AS Donor_Count
  2  FROM Donor
  3  GROUP BY BloodType
  4  ORDER BY Donor_Count DESC;

BLOOD DONOR_COUNT
----- -----------
B+             12
A-              6
O+              6
B-              5
AB+             4
O-              3
A+              1
AB-             1

8 rows selected.
```

Figure 11: Distribution of Blood Types Among Donors

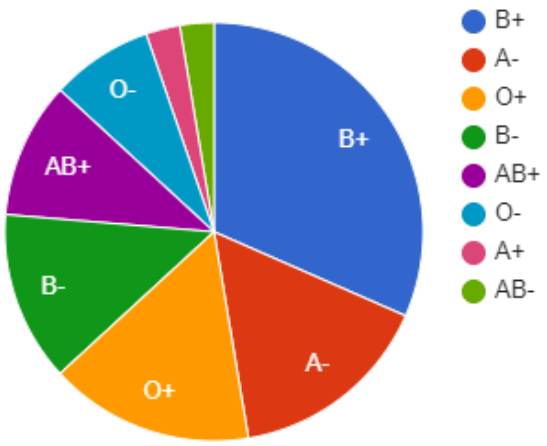

Figure 12: Distribution of Blood Types Among Donors (Detail)

Most donors have blood type B+, followed by A- and O+. The least common types are A+ and AB- (Figure 12).

10.5 Monthly Donations by Blood Type

```
SQL> SELECT TO_CHAR(DonationDate, 'MM') AS Month, BloodType, COUNT(*) AS Donation_Count
  2  FROM BloodDonation
  3  JOIN Donor ON BloodDonation.DonorID = Donor.DonorID
  4  GROUP BY TO_CHAR(DonationDate, 'MM'), BloodType
  5  ORDER BY TO_CHAR(DonationDate, 'MM') ASC, BloodType;

MO BLOOD DONATION_COUNT
-- ----- --------------
01 B+                 1
01 B-                 1
01 O+                 2
02 A-                 2
02 B+                 4
03 AB-                1
03 O+                 1
03 O-                 1
04 A+                 1
04 AB+                1
04 B+                 2

MO BLOOD DONATION_COUNT
-- ----- --------------
04 O+                 1
05 A-                 1
05 B-                 2
06 AB+                1
06 B+                 2
06 O-                 1
07 A-                 2
07 B+                 2
08 B+                 3
08 B-                 1
08 O+                 1

MO BLOOD DONATION_COUNT
-- ----- --------------
08 O-                 1
09 B+                 1
10 A-                 1
10 B+                 1
11 B-                 1
11 O+                 1
12 AB+                1
12 O+                 1

30 rows selected.
```

Figure 13: Monthly Donations by Blood Type

Month	Blood Group	Donation Count
1	B+	1
1	B-	1
1	O+	2
2	A-	2
2	B+	4
3	AB-	1
3	O+	1
3	O-	1
4	A+	1
4	AB+	1
4	B+	2
4	O+	1
5	A-	1
5	B-	2
6	AB+	1
6	B+	2
6	O-	1
7	A-	2
7	B+	2
8	B+	3
8	B-	1
8	O+	1
8	O-	1
9	B+	1
10	A-	1
10	B+	1
11	B-	1
11	O+	1
12	AB+	1
12	O+	1

Figure 14: Monthly Donations by Blood Type (Detail)

Figure 14 displays the distribution of blood types for each month in 2023.

10.6 Donors with Medical History by Blood Type

```
SQL>
SQL> SELECT BloodType, COUNT(*) AS Medical_History_Count
  2  FROM Donor
  3  WHERE DonorHistory <> 'No previous donations'
  4  GROUP BY BloodType
  5  ORDER BY Medical_History_Count DESC;

BLOOD MEDICAL_HISTORY_COUNT
----- ---------------------
B+                       11
A-                        6
AB+                       3
O+                        3
B-                        3
A+                        1
AB-                       1
O-                        1

8 rows selected.
```

Figure 15: Donors with Medical History by Blood Type

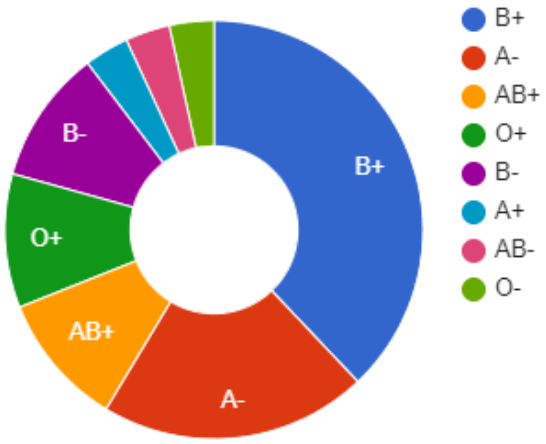

Figure 16: Donors with Medical History by Blood Type (Detail)

Most donors with a medical history have blood type B+, consistent with the overall donation data (Figure 16).

10.7 Average Volume of Blood Donated per Donation Location

```
SQL> SELECT DonationLocation, AVG(VolumeOfBloodDonated) AS Average_Volume
  2  FROM BloodDonation
  3  GROUP BY DonationLocation
  4  ORDER BY Average_Volume DESC;

DONATIONLOCATION                                   AVERAGE_VOLUME
-------------------------------------------------- --------------
Community Center                                       511.428571
Red Cross Center                                       502.857143
City Hospital                                          459.285714
```

Figure 17: Average Volume of Blood Donated per Donation Location

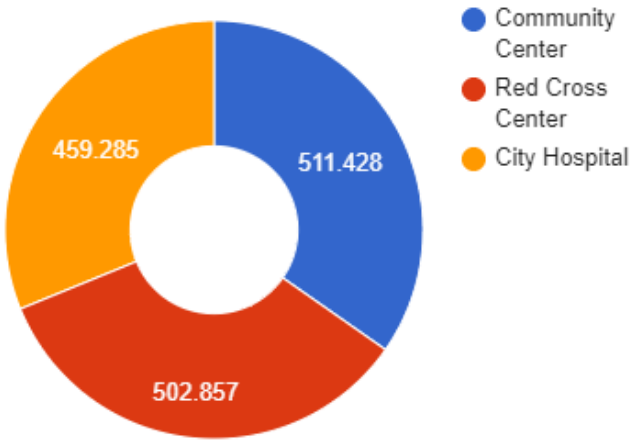

Figure 18: Average Volume of Blood Donated per Donation Location (Detail)

Community and Red Cross Centers receive more donations compared to City Hospitals (Figure 18).

10.8 Monthly Donations at Each Donation Location

```
SQL> SELECT TO_CHAR(DonationDate, 'MM') AS Month, DonationLocation, COUNT(*) AS Donation_Count
  2  FROM BloodDonation
  3  GROUP BY TO_CHAR(DonationDate, 'MM'), DonationLocation
  4  ORDER BY TO_CHAR(DonationDate, 'MM') ASC, DonationLocation;

MO DONATIONLOCATION                                DONATION_COUNT
-- ---------------------------------------------- --------------
01 City Hospital                                              3
01 Community Center                                           1
02 City Hospital                                              1
02 Community Center                                           4
02 Red Cross Center                                           1
03 City Hospital                                              2
03 Red Cross Center                                           1
04 City Hospital                                              1
04 Community Center                                           1
04 Red Cross Center                                           3
05 Community Center                                           2

MO DONATIONLOCATION                                DONATION_COUNT
-- ---------------------------------------------- --------------
05 Red Cross Center                                           1
06 Red Cross Center                                           4
07 City Hospital                                              3
07 Red Cross Center                                           1
08 City Hospital                                              2
08 Community Center                                           4
09 Red Cross Center                                           1
10 City Hospital                                              2
11 Community Center                                           2
12 Red Cross Center                                           2

21 rows selected.
```

Figure 19: Monthly Donations at Each Donation Location

Month	Donation Location	Donation Count
1	City Hospital	3
1	Community Center	1
2	City Hospital	1
2	Community Center	4
2	Red Cross Center	1
3	City Hospital	2
3	Red Cross Center	1
4	City Hospital	1
4	Community Center	1
4	Red Cross Center	3
5	Community Center	2
5	Red Cross Center	1
6	Red Cross Center	4
7	City Hospital	3
7	Red Cross Center	1
8	City Hospital	2
8	Community Center	4
9	Red Cross Center	1
10	City Hospital	2
11	Community Center	2
12	Red Cross Center	2

Figure 20: Monthly Donations at Each Donation Location (Detail)

Figure 20 shows the donation count for each location every month.

10.9 Screening Results by Infection Type

```
SQL> SELECT TestType, COUNT(*) AS Positive_Count
  2  FROM ScreeningResults
  3  WHERE TestResult = 'Positive'
  4  GROUP BY TestType
  5  ORDER BY Positive_Count DESC;

TESTTYPE   POSITIVE_COUNT
---------- --------------
HBV                     9
HIV                     4
HCV                     3
```

Figure 21: Screening Results by Infection Type

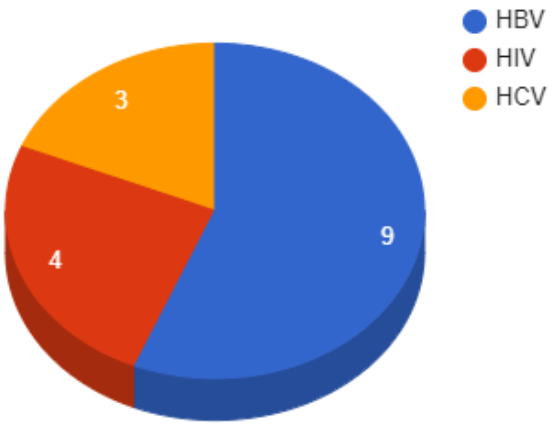

Figure 22: Screening Results by Infection Type (Detail)

More than 50% of detected infections are HBV (Figure 22).

10.10 Transmission Routes of Transmitted Infections

```
SQL> SELECT TransmissionRoute, COUNT(*) AS Transmission_Count
  2  FROM TransmittedInfections
  3  GROUP BY TransmissionRoute
  4  ORDER BY Transmission_Count DESC;

TRANSMISSIONROUTE                                  TRANSMISSION_COUNT
-------------------------------------------------- ------------------
Unknown                                                             7
Blood transfusion                                                   3
```

Figure 23: Transmission Count per Transmission Route

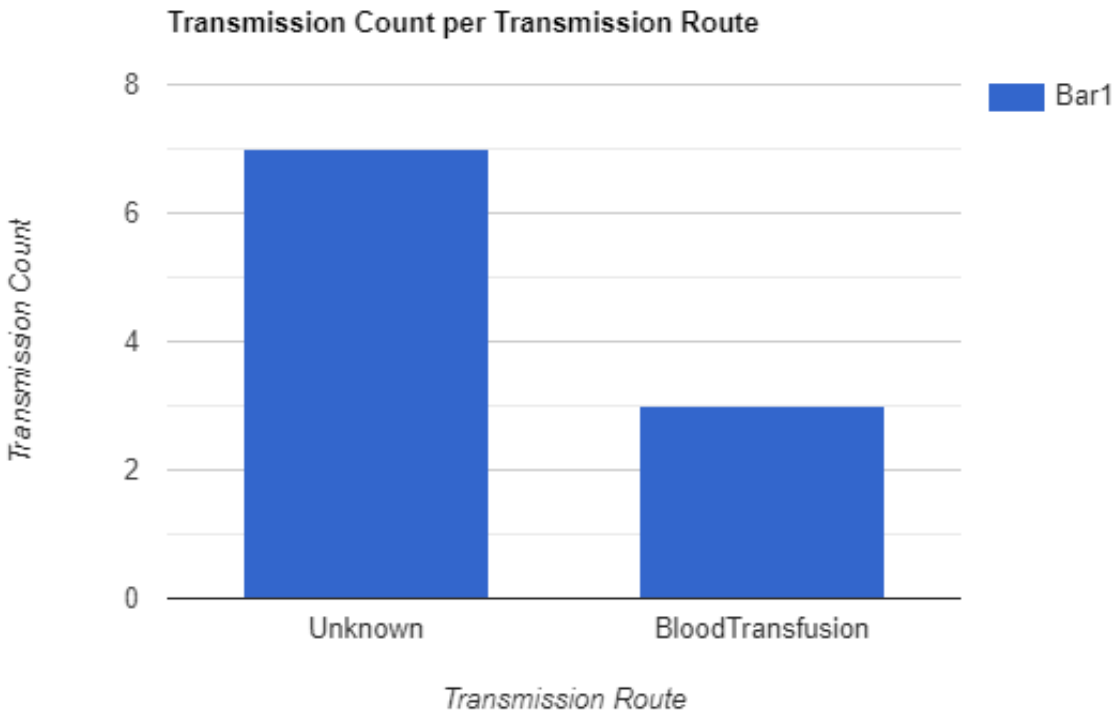

Figure 24: Transmission Count per Transmission Route (Detail)

The figure displays the number of times the transmission method is known to be through blood transfusion (Figure 24).

11 Conclusion

In conclusion, this paper has presented a comprehensive analysis of Transmitted Infections among Blood Donors, utilizing SQL queries, database tables, ER diagrams, and graph visualization techniques. Through the examination of the data, several key insights have been uncovered regarding the prevalence and distribution of infections among blood donors. The findings underscore the importance of robust screening processes and donor education programs to mitigate the risk of infection transmission through blood transfusions. Additionally, the use of visualizations has enhanced our understanding of the data, enabling more informed decision-making in blood donation management. Moving forward, further research and continuous monitoring of infection trends are crucial to ensuring the safety and efficacy of blood transfusion practices.

References

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