

dfd blood bank management system PDF

Understanding the DFD Blood Bank Management System

DFD blood bank management system is a comprehensive solution designed to streamline the operations of blood banks, ensuring efficient management of blood inventory, donor information, patient data, and blood transfusion processes. With the increasing demand for safe and timely blood transfusions, implementing a robust management system becomes essential. This system leverages Data Flow Diagrams (DFD) to visualize and optimize the flow of data within the blood bank, leading to improved accuracy, faster processing, and enhanced service delivery.

What is a DFD Blood Bank Management System?

Definition and Purpose

A DFD blood bank management system is a software framework that uses Data Flow Diagrams to model how data moves through various components of a blood bank. Its primary purpose is to facilitate the effective handling of blood donations, storage, testing, and distribution, ensuring that blood products are available, safe, and efficiently allocated to patients in need.

Key Features of the System

- Donor registration and management
- Blood donation scheduling
- Blood inventory tracking
- Blood testing and safety checks
- Request and allocation for blood transfusion
- Reporting and analytics
- User role management (admin, staff, donors)

Core Components of DFD in Blood Bank Management

Data Flow Diagrams (DFDs) Explained

DFDs visually represent how data moves between different parts of a system. They depict processes, data stores, external entities, and data flows, helping developers and stakeholders understand system operations and identify areas for optimization.

Levels of DFDs

- **Level 0 (Context Diagram):** Provides a high-level overview of the entire system, showing how it interacts with external entities like donors, patients, and hospitals.
- **Level 1:** Breaks down main processes such as donor management, blood inventory, and transfusion requests.
- **Level 2 and beyond:** Offers detailed views of each process, including specific data flows, validations, and storage mechanisms.

Designing a DFD Blood Bank Management System

Step-by-step Approach

- **Identify External Entities:** Donors, Patients, Blood Banks, Hospitals
- **Define Main Processes:** Donor Registration, Blood Collection, Testing & Processing, Inventory Management, Blood Request & Allocation, Reporting
- **Establish Data Stores:** Donor Database, Blood Inventory Database, Test Results Storage, Transfusion Records
- **Create Data Flows:** Blood donation data, test results, blood requests, transfusion data, inventory updates

Sample Data Flow

- Donor submits donation information to the system.
- Blood collected is tested and stored.
- Hospital requests blood, which is allocated from inventory.
- All transactions are recorded for accountability and reporting.

Advantages of Implementing a DFD Blood Bank Management System

Efficiency and Accuracy

- Automates routine tasks reducing manual errors.
- Ensures real-time updates of blood inventory.
- Facilitates quick retrieval of donor and patient information.

Enhanced Safety and Compliance

- Tracks blood testing and safety checks meticulously.
- Maintains detailed records for audits and compliance.

Improved Service Delivery

- Reduces waiting time for blood requests.
- Provides better donor management and communication.
- Supports data-driven decision-making through analytics.

Implementation Challenges and Solutions

Challenges

- Data security and privacy concerns
- Integration with existing hospital systems
- User training and adaptation
- Data accuracy and consistency

Solutions

- Implement robust encryption and access controls
- Develop APIs for seamless integration
- Conduct comprehensive training sessions
- Establish validation protocols and regular audits

Tools and Technologies for Developing a DFD Blood Bank Management System

Popular Tools

- Microsoft Visio
- Lucidchart
- Draw.io
- SmartDraw

Technologies to Consider

- Database Management Systems (MySQL, PostgreSQL)
- Backend Frameworks (Django, Laravel, Node.js)
- Frontend Frameworks (React, Angular, Vue.js)
- Security Protocols (SSL/TLS, OAuth)

Best Practices for a Successful DFD Blood Bank System

Engage Stakeholders Early

Involve donors, healthcare providers, and administrative staff during the design phase to ensure the system meets real-world needs.

Prioritize Data Security

Implement encryption, secure access controls, and regular audits to protect sensitive data.

Focus on User Experience

Design intuitive interfaces to facilitate easy adoption by staff and donors.

Plan for Scalability

Ensure the system can handle increased data volume and user load as the blood bank expands.

Future Trends in Blood Bank Management Systems

Integration with AI and Machine Learning

AI can predict blood demand, optimize inventory, and identify potential donor matches more effectively.

Blockchain for Data Integrity

Blockchain technology can enhance transparency and traceability of blood products from donation to transfusion.

Mobile Applications

Developing mobile apps for donors and staff can improve communication, appointment scheduling, and real-time updates.

Conclusion

The **DFD blood bank management system** is an indispensable tool for modern blood banks aiming to enhance operational efficiency, safety, and service quality. By carefully designing data flow diagrams and leveraging appropriate technologies, blood banks can streamline their processes, reduce errors, and save lives. As technology advances, integrating AI, blockchain, and mobile solutions will further revolutionize blood bank management, ensuring safer and more reliable blood transfusion services worldwide.

DFD Blood Bank Management System is a comprehensive software solution designed to streamline and optimize the operations of blood banks. With the increasing demand for safe and efficient blood transfusion services, a robust management system becomes essential to handle various processes such as donor registration, blood inventory management, testing, and distribution. This article provides an in-depth review of the DFD Blood Bank Management System, exploring its features, benefits, limitations, and overall impact on blood bank operations.

Introduction to DFD Blood Bank Management System

The DFD (Data Flow Diagram) Blood Bank Management System is a specialized software application aimed at simplifying the complex workflows involved in managing blood banks. It leverages data flow diagrams to visualize system processes, data storage, and interactions, ensuring clarity in design and implementation. The primary goal of this system is to improve accuracy, efficiency, and accountability in blood collection, testing, storage, and distribution.

The system integrates various modules that work harmoniously to facilitate smooth operations, reduce manual errors, and enhance data security. Its user-friendly interface and modular architecture allow staff at different levels to perform their duties effectively, thereby improving overall service quality.

Core Features of DFD Blood Bank Management System

Understanding the core features of the DFD Blood Bank Management System is crucial to appreciating its value. These features address the key operational needs of blood banks:

1. Donor Management

- Registration and Profile Maintenance: Collects detailed donor information, including personal details, medical history, and donation frequency.
- Donation Scheduling: Automates appointment scheduling and reminders to donors.
- Donation Tracking: Keeps record of past donations, eligibility status, and health assessments.

2. Blood Inventory Management

- Blood Collection and Storage: Tracks blood units from collection to storage, including blood type, component separation, and expiration dates.
- Blood Testing and Screening: Integrates testing results for infectious diseases, ensuring blood safety.
- Stock Monitoring: Provides real-time updates on available blood units, shortages, and expiry alerts.

3. Blood Testing and Screening

- Integration with Lab Equipment: Automates data entry from testing devices.
- Result Management: Stores and manages test results for each blood unit.
- Quality Control: Ensures compliance with safety standards and regulatory requirements.

4. Blood Transfusion Management

- Recipient Registration: Maintains records of patients and transfusion history.
- Compatibility Checks: Ensures proper blood matching to avoid transfusion reactions.
- Transfusion Scheduling: Organizes and records transfusion procedures.

5. Reporting and Analytics

- Report Generation: Produces reports on donor activity, blood stock levels, and transfusion history.
- Data Analysis: Provides insights into donation trends, demand forecasting, and operational efficiency.
- Compliance Reporting: Supports regulatory submissions and audits.

Advantages of Using DFD Blood Bank Management System

Implementing this system offers numerous benefits to blood banks, healthcare providers, and patients alike:

- Enhanced Accuracy: Automates data entry and processing, reducing human errors.
- Improved Efficiency: Streamlines workflows, reduces paperwork, and accelerates operations.

- Better Inventory Control: Maintains optimal stock levels, preventing shortages and wastage.
- Increased Safety: Ensures thorough testing, proper documentation, and compliance with safety standards.
- Data Security: Protects sensitive donor and patient information through secure access controls.
- Real-Time Monitoring: Provides instant updates on blood stock, donor statuses, and testing results.
- Regulatory Compliance: Facilitates adherence to health standards and simplifies audits.
- User-Friendly Interface: Simplifies training and daily usage for staff members.

Challenges and Limitations

Despite its numerous advantages, the DFD Blood Bank Management System also faces certain challenges and limitations:

- Initial Implementation Cost: Setting up the system involves expenses related to software purchase, hardware, and training.
- Technical Expertise Requirement: Staff need adequate training to operate and maintain the system effectively.
- Integration Complexities: Compatibility with existing hospital information systems may require additional customization.
- Data Migration Risks: Transferring existing data into the new system can pose risks of data loss or inaccuracies.
- Dependence on Infrastructure: System downtime due to technical issues or power outages can disrupt operations.
- Need for Continuous Updates: Regulatory changes and technological advancements necessitate regular system updates.

Implementation Considerations

Successful deployment of the DFD Blood Bank Management System hinges on careful planning and execution. Key considerations include:

- Needs Assessment: Understanding specific requirements of the blood bank to tailor the system accordingly.
- Stakeholder Involvement: Engaging staff, management, and IT personnel throughout the process to ensure buy-in and smooth transition.
- Training and Support: Providing comprehensive training sessions and ongoing technical support.
- Data Security Measures: Implementing robust security protocols to safeguard sensitive data.

- Maintenance and Updates: Establishing routines for system maintenance, backups, and updates to keep the system current and reliable.

Comparison with Traditional Systems

Traditional blood bank management often relies heavily on manual record-keeping, spreadsheets, and physical documentation. Compared to these methods, the DFD Blood Bank Management System offers:

Aspect	Traditional System	DFD Blood Bank Management System
Accuracy	Prone to human errors	Significantly reduced errors through automation
Speed	Slow data retrieval and processing	Fast access and real-time updates
Data Security	Limited controls, risk of loss	Secure access controls and backups
Inventory Management	Manual tracking, prone to oversight	Automated, real-time monitoring
Reporting	Manual compilation, time-consuming	Automated report generation

This comparison highlights the transformative impact of adopting a digital system in blood bank operations.

Future Trends and Enhancements

The landscape of blood bank management systems is evolving rapidly, with emerging trends promising further improvements:

- Integration with Mobile Apps: Facilitates donor registration, appointment scheduling, and alerts via smartphones.
- Artificial Intelligence (AI): Enhances demand forecasting, donor recruitment strategies, and quality assurance.
- Blockchain Technology: Ensures tamper-proof records for transparency and traceability.
- Cloud-Based Solutions: Offers scalability, remote access, and reduced infrastructure costs.
- Automated Testing Integration: Incorporating advanced laboratory automation for faster test processing.

Conclusion

The DFD Blood Bank Management System represents a significant advancement in the management of blood bank operations. Its comprehensive features, automation capabilities, and focus on safety and efficiency make it an indispensable tool for modern blood banks. While implementation requires careful planning and investment, the long-term benefits—improved accuracy, operational efficiency, enhanced safety, and regulatory compliance—far outweigh the challenges.

As technology continues to advance, blood banks that adopt such digital solutions will be better positioned to meet the growing demand for safe blood transfusions, improve donor engagement, and ensure optimal resource utilization. Embracing these systems is not just a technological upgrade but a vital step toward saving more lives through better management and delivery of blood services.

Question What is a DFD Blood Bank Management System? A DFD Blood Bank Management System is a software application that uses Data Flow Diagrams (DFD) to model and manage the processes involved in blood bank operations, such as donor registration, blood collection, testing, storage, and distribution. **How does a DFD help in managing blood bank processes?** A DFD provides a visual representation of data flow within the blood bank, helping stakeholders understand, analyze, and optimize processes like blood inventory management, donor data handling, and blood transfusion tracking. **What are the key components of a DFD Blood Bank Management System?** Key components include external entities (donors, hospitals), processes (donor registration, blood testing, storage), data stores (blood inventory, donor database), and data flows (blood requests, donor information, test results). **What are the benefits of implementing a DFD-based blood bank system?** Benefits include improved data accuracy, efficient inventory management, streamlined workflows, quick access to blood availability, better donor management, and enhanced overall operational efficiency. **Can a DFD Blood Bank Management System integrate with other hospital systems?** Yes, it can be integrated with hospital information systems, laboratory systems, and electronic health records to ensure seamless data exchange and better coordination. **What are common challenges faced when developing a DFD Blood Bank Management System?** Challenges include ensuring data security and privacy, accurately modeling complex processes, maintaining real-time data updates, and integrating with existing hospital systems. **How does automation in a DFD Blood Bank Management System improve blood safety?** Automation reduces human errors in blood testing, labeling, and record-keeping, ensuring safer transfusions and better traceability of blood products. **What future trends are expected in DFD Blood Bank Management Systems?** Future trends include incorporating AI for predictive analytics, using cloud-based solutions for scalability, implementing RFID for inventory tracking, and enhancing data security measures.

Related keywords: blood bank management, blood donor database, blood inventory system, blood donation tracking, blood request management, blood testing records, blood component processing,

donor appointment scheduling, blood compatibility testing, inventory reporting

Basics Of Blood Management

Basics of Blood Management

Blood management is a critical aspect of modern healthcare, encompassing strategies and practices aimed at ensuring the optimal use, conservation, and safety of blood and blood products. Effective blood management not only improves patient outcomes but also minimizes risks associated with transfusions and conserves vital blood resources. This comprehensive guide explores the fundamental concepts, techniques, and importance of blood management in clinical settings.

Understanding Blood Management: An Overview

Blood management involves a multidisciplinary approach that integrates clinical practices, patient assessment, blood conservation techniques, and safety protocols. It aims to reduce unnecessary transfusions, enhance patient care, and ensure that blood products are available when needed.

Definition of Blood Management

Blood management refers to the systematic, evidence-based practices used to optimize the use of blood and blood components, minimize transfusion-related risks, and promote patient-centered care.

Objectives of Blood Management

- Minimize unnecessary blood transfusions
- Improve patient safety
- Optimize blood utilization
- Reduce blood wastage
- Enhance clinical outcomes
- Ensure blood product safety and compatibility

Core Components of Blood Management

Effective blood management comprises several essential elements that collectively improve transfusion practices and patient outcomes.

1. Patient Blood Management (PBM)

Patient Blood Management involves individualized assessment and intervention strategies to improve a patient's hemoglobin levels and overall health status before, during, and after surgery or medical treatment.

Key aspects include:

- Preoperative anemia management
- Optimization of coagulation
- Minimizing blood loss
- Postoperative recovery strategies

2. Blood Conservation Techniques

Implementing methods to reduce blood loss and conserve blood during surgical and medical procedures.

Common techniques include:

- Use of minimally invasive surgical techniques
- Application of topical hemostatic agents
- Controlled hypotension during surgery
- Use of cell salvage systems
- Pharmacological agents (e.g., tranexamic acid)

3. Blood Product Selection and Compatibility

Ensuring the correct matching of blood types to prevent transfusion reactions.

Key points:

- ABO and Rh compatibility testing
- Cross-matching procedures
- Use of leukocyte-reduced and irradiated blood components when necessary

4. Transfusion Safety and Monitoring

Ensuring the safety of blood transfusions through rigorous testing, proper administration, and post-transfusion monitoring.

Safety measures include:

- Donor screening
- Testing for infectious diseases
- Proper storage and handling
- Vigilant monitoring for adverse reactions

Principles of Blood Management

Understanding and applying core principles are vital for effective blood management.

1. Judicious Use of Blood

Transfuse only when clinically indicated, based on evidence-based guidelines and patient-specific factors.

2. Minimizing Blood Loss

Apply surgical and medical techniques to reduce bleeding.

3. Optimizing Patient's Hematologic Status

Treat underlying causes of anemia, such as nutritional deficiencies or chronic disease, before considering transfusion.

4. Safe and Appropriate Transfusion Practices

Follow strict protocols for blood compatibility, administration, and monitoring.

Importance of Blood Management in Healthcare

Implementing effective blood management practices has numerous benefits:

- Patient Safety: Reduces the risk of transfusion reactions, infections, and immunomodulation.
- Resource Conservation: Ensures efficient use of blood supplies, reducing wastage.
- Cost-effectiveness: Decreases healthcare costs associated with transfusions and complications.

- Improved Outcomes: Enhances recovery, reduces hospital stay, and promotes overall patient well-being.
- Public Health Impact: Contributes to the sustainable management of blood resources globally.

Steps in Blood Management Process

A typical blood management process involves several sequential steps:

- **Assessment and Planning:** Evaluate the patient's condition, hemoglobin levels, and surgical or medical needs.
- **Preoperative Optimization:** Treat anemia, optimize coagulation, and plan surgical techniques to reduce blood loss.
- **Intraoperative Management:** Employ blood conservation techniques and monitor blood loss meticulously.
- **Postoperative Care:** Continue monitoring hemoglobin levels, prevent bleeding, and consider transfusion if necessary.

Role of Healthcare Professionals in Blood Management

Effective blood management relies heavily on the collaborative efforts of various healthcare professionals:

- Hematologists: Provide expertise on blood disorders and transfusion medicine.
- Surgeons and Anesthesiologists: Implement blood conservation techniques during procedures.
- Nurses: Monitor patient response and manage transfusions safely.
- Laboratory Technicians: Conduct compatibility testing and blood screening.
- Hospital Administrators: Ensure policies, training, and resources are in place for safe blood management.

Challenges and Future Directions in Blood Management

While significant progress has been made, several challenges persist:

- Limited blood supplies in certain regions
- Risk of transfusion-transmitted infections
- Managing rare blood types
- Ensuring adherence to guidelines

Future directions include:

- Development of synthetic blood substitutes
- Advanced blood screening technologies
- Personalized medicine approaches
- Enhanced patient education and awareness

Conclusion

The **basics of blood management** encompass a comprehensive set of strategies aimed at optimizing the use of blood products, minimizing associated risks, and improving patient outcomes. By understanding the core principles?judicious use, blood conservation, safety, and patient-centered care?healthcare providers can ensure efficient and effective transfusion practices. As advancements continue, the goal remains to provide safe, sustainable, and personalized blood management solutions that benefit both individual patients and the broader healthcare system.

Keywords: blood management, patient blood management, blood conservation, transfusion safety, blood transfusion, blood products, hemoglobin, blood compatibility, blood safety protocols, blood conservation techniques

Basics of Blood Management: A Comprehensive Guide for Healthcare Professionals and Patients

Blood management is a critical aspect of modern healthcare, encompassing strategies and practices designed to optimize the use of blood and blood components to improve patient outcomes. In an era where blood safety, efficiency, and resource conservation are paramount, understanding the basics of blood management is essential for clinicians, surgeons, and even informed patients. This guide aims to provide a detailed overview of the fundamental principles, techniques, and considerations involved in blood management, highlighting its significance in clinical settings.

Introduction to Blood Management

Blood management refers to a multidisciplinary approach aimed at reducing unnecessary blood transfusions, ensuring patient safety, and conserving blood resources. It involves a combination of preoperative, intraoperative, and postoperative strategies to minimize blood loss and enhance the body's natural ability to recover from anemia or blood loss.

Historically, blood transfusions have been a cornerstone of supportive care in various medical conditions, from trauma to surgery. However, over the years, the focus has shifted toward evidence-based practices that promote judicious use of blood, avoiding potential risks such as transfusion reactions, infections, and immunomodulation.

The Importance of Blood Management

Effective blood management has several key benefits:

- Patient Safety: Reduces risks associated with transfusions, including transfusion reactions, infections, and immunological complications.
- Resource Conservation: Saves valuable blood supplies, which are often limited and costly.
- Cost-effectiveness: Minimizes healthcare expenses related to blood procurement, testing, and storage.
- Improved Outcomes: Enhances recovery and reduces hospital stay durations by preventing unnecessary transfusions.

Core Principles of Blood Management

The basics of blood management hinge on three interconnected principles:

- Optimizing Hemoglobin Levels Preoperatively or Pre-treatment
- Minimizing Blood Loss During Procedures
- Enhancing the Patient's Ability to Tolerate Anemia

Let's explore each in detail.

Preoperative Blood Management Strategies

Preparation before surgery or treatment is vital to reduce the need for transfusions.

1. Anemia Screening and Treatment

- Screening: Routine testing for anemia allows early detection of low hemoglobin levels.
- Treatment: Correcting anemia preoperatively with iron supplementation (oral or intravenous), vitamin B12, or erythropoietin stimulating agents improves patient resilience to blood loss.

2. Patient Optimization

- Addressing nutritional deficiencies.
- Managing chronic illnesses that may contribute to anemia.
- Discontinuing medications that impair clotting (e.g., anticoagulants) when appropriate.

3. Planning and Patient Blood Management (PBM) Programs

- Developing individualized plans to optimize patient outcomes.
- Educating patients about blood conservation strategies.

Intraoperative Blood Management Techniques

During surgery or invasive procedures, steps are taken to reduce blood loss:

1. Surgical Techniques

- Use of meticulous hemostasis (e.g., cautery, clips).
- Employing minimally invasive surgical methods where possible.
- Application of topical hemostatic agents.

2. Blood Conservation Devices

- Cell Salvage: Collecting and reinfusing the patient's own blood lost during surgery.
- Controlled Hypotension: Lowering blood pressure temporarily to reduce bleeding.

3. Pharmacologic Agents

- Antifibrinolytics: Drugs like tranexamic acid or aminocaproic acid help stabilize blood clots.
- Desmopressin: Used in specific cases to promote clotting.

Postoperative Blood Management

After surgery, focus shifts to recovery:

- Monitoring hemoglobin and hematocrit levels.
- Continuing iron or erythropoietin therapy if indicated.
- Avoiding unnecessary blood transfusions unless clinically justified.
- Using restrictive transfusion thresholds based on evidence-based guidelines.

Blood Transfusion: When Is It Necessary?

While blood transfusions can be lifesaving, they are not without risks. Indications for transfusion typically include:

- Hemoglobin below a certain threshold (often
- Significant ongoing bleeding.
- Hemodynamic instability or signs of tissue hypoxia.

Decision-making should always involve a careful assessment of risks and benefits, and whenever possible, alternatives should be considered.

Alternatives to Transfusion

To reduce reliance on transfusions, several alternatives are utilized:

- Pharmacologic agents (e.g., antifibrinolytics, erythropoietin).
- Volume expanders: Crystalloids or colloids to maintain blood pressure.
- Autologous blood donation: Patients donate their own blood prior to elective procedures.
- Bloodless surgery techniques: Employing the strategies outlined above to avoid transfusion altogether.

Safety and Ethical Considerations

Ensuring blood safety involves rigorous screening for infectious agents and proper storage. Ethical considerations include respecting patient autonomy and cultural or religious beliefs regarding blood transfusions.

The Future of Blood Management

Advances in technology and research are continuously shaping the field:

- Development of synthetic blood products.
- Improved blood conservation devices.
- Personalized medicine approaches to optimize individual patient care.

Conclusion

The basics of blood management encompass a comprehensive set of practices aimed at reducing unnecessary blood transfusions, enhancing patient safety, and conserving precious blood

resources. From preoperative optimization, intraoperative techniques, to postoperative care, each stage plays a vital role in effective blood management strategies. As healthcare continues to evolve, a multidisciplinary approach rooted in evidence-based practices will remain fundamental in ensuring optimal patient outcomes while safeguarding blood supplies for those in critical need.

Remember: Effective blood management is not just about avoiding transfusions; it's about ensuring that every patient receives the safest, most appropriate care tailored to their needs. Whether you're a healthcare professional or a patient seeking understanding, embracing these principles contributes to safer, more efficient healthcare experiences.

Question What is blood management and why is it important? Blood management involves the strategies and practices used to optimize the use of blood and blood products, ensuring patient safety, reducing unnecessary transfusions, and conserving blood resources. What are common methods used in blood management? Common methods include preoperative anemia assessment, minimizing blood loss during surgery, using blood conservation techniques, and applying evidence-based transfusion practices. How can preoperative anemia management improve blood management outcomes? Treating anemia before surgery with iron therapy or other interventions reduces the likelihood of transfusions, leading to better patient outcomes and conserving blood supplies. What is Patient Blood Management (PBM)? PBM is a multidisciplinary approach aimed at optimizing a patient's own blood volume and health to reduce the need for allogeneic blood transfusions and improve clinical outcomes. Why is restrictive transfusion strategy recommended in blood management? Restrictive strategies, such as transfusing only when hemoglobin levels fall below a certain threshold, reduce unnecessary transfusions and associated risks without compromising patient safety. What role do blood conservation techniques play in blood management? Techniques like intraoperative cell salvage, minimizing surgical bleeding, and using pharmacologic agents help conserve blood and reduce transfusion needs. How does proper blood management impact patient safety? Effective blood management minimizes transfusion-related complications, reduces infection risks, and improves overall patient recovery and outcomes. What are the benefits of implementing blood management protocols in hospitals? Benefits include reduced blood product usage, lower healthcare costs, improved patient outcomes, and better resource allocation. What are the challenges faced in implementing blood management programs? Challenges include limited resources, lack of staff training, resistance to change, and the need for multidisciplinary coordination and institutional support.

Related keywords: blood transfusion, blood collection, blood safety, blood components, blood donation, blood testing, blood storage, blood typing, blood compatibility, blood conservation

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