

**TOBB ETU**

**Economy & Technology University**

**BIL 495 / YAP 495**

**Software Requirements Specification (SRS)**

***Reference:*** *IEEE 830-1998 / ISO/IEC/IEEE 29148:2018*

## Document Control Table

|  |  |
| --- | --- |
| Document Title | Project Closure Report |
| Document ID | (To be assigned) |
| Prepared By (Author) | manifetch |
| Reviewed By |  |
| Approved By |  |
| Preparation Date | 28.10.2025 |
| Approval Date |  |
| Version / Revision | 1.0 |
| Confidentiality Level | Internal / Restricted / Public |
| Reference Standards | IEEE 15288, IEEE 12207, INCOSE SE Handbook v5 |

## Change Record (Revision History Table)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Revision | Date | Prepared By | Reviewed/Approved By | Description of Change |
| 1.0 | 28.10.25 | manifetch | (Approver) | Initial Release |
| 1.1 |  |  |  | Minor editorial updates |
| 1.2 |  |  |  | Added stakeholder feedback section |

[1. Introduction](#_heading=)

[1.1 Purpose](#_heading=)

[1.2 Scope](#_heading=)

[1.3 Definitions, Acronyms, Abbreviations](#_heading=)

[1.4 References](#_heading=)

[1.5 Overview](#_heading=)

[2. Overall Description](#_heading=)

[2.1 Product Perspective](#_heading=)

[2.2 Product Functions](#_heading=)

[2.3 User Characteristics](#_heading=)

[2.4 Constraints](#_heading=)

[2.5 Assumptions and Dependencies](#_heading=)

[3. Specific Requirements](#_heading=)

[3.1 Functional Requirements](#_heading=)

[3.2 External Interface Requirements](#_heading=)

[3.3 Performance Requirements](#_heading=)

[3.4 Design Constraints](#_heading=)

[3.5 Software System Attributes](#_heading=)

[3.6 Other Requirements](#_heading=)

[4. Appendices](#_heading=)

[4. References](#_heading=h.a6qvajnlk889)

## 1. Introduction

## Purpose

This document defines the functional and non-functional requirements for the development of a web-based NICU Clinical Dashboard integrating real-time signal monitoring and AI-assisted diagnosis.  
It serves as a formal reference for developers, academic supervisors, and the industrial partner (Ertunç Özcan Import & Representation) to ensure a shared understanding of system expectations, design boundaries, and performance goals.

## 1.2 Scope

The NICU Clinical Dashboard aims to provide a secure and scalable solution for monitoring neonatal vital signs (ECG, SpO₂, respiration rate) through IoMT-integrated devices.  
The system supports:

* Real-time physiological signal visualization
* AI-based diagnostic alerts for respiratory and cardiac risks
* Automated report generation (PDF)
* Role-based access (doctor, nurse, administrator)
* Scalable backend architecture for multi-user access

The prototype version will support 5–10 concurrent users, with long-term scalability up to 50 users within a single NICU unit.

## 1.3 Definitions, Acronyms, Abbreviations

| **Term** | **Definition** |
| --- | --- |
| NICU | Neonatal Intensive Care Unit |
| IoMT | Internet of Medical Things |
| ECG | Electrocardiogram |
| SpO*₂* | Oxygen saturation level |
| AI | Artificial Intelligence |
| API | Application Programming Interface |
| HL7 / FHIR | Health data exchange standards |
| HIPAA | Health Insurance Portability and Accountability Act |
| GDPR | General Data Protection Regulation |

## 1.4 References

See Section 5 for full reference list.

## 1.5 Overview

This document is structured as follows:

* Section 2: General system description, context, and user environment.
* Section 3: Specific functional and non-functional requirements.
* Section 4: Appendices (traceability and requirement mappings).
* Section 5: References to standards and supporting literature.

## 2. Overall Description

## 2.1 Product Perspective

The NICU dashboard operates as a standalone clinical web platform interfacing with:

* IoMT devices or synthetic data simulators (e.g., BioSPPy, NeuroKit2)
* A backend server managing storage and analytics (Flask/Node.js)
* An AI module providing diagnostic predictions
* A secure frontend dashboard (React-based) for end-users
* It functions within hospital networks and supports on-premise deployment.

## 2.2 Product Functions

* Display real-time neonatal physiological signals (ECG, SpO₂, respiration).
* Generate AI-driven diagnostic results for distress detection.
* Produce and export clinical reports in PDF format.
* Trigger alert mechanisms (visual/audio) when thresholds are exceeded.
* Manage users with role-based access and secure login.
* Store and retrieve time-series data for trend analysis.

## 2.3 User Characteristics

| **User Type** | **Role** | **Technical Expertise** | **Goals** |
| --- | --- | --- | --- |
| Clinicians (Doctors) | Interpret AI results and monitor patients | Intermediate | Diagnose and act on risk alerts |
| Nurses | Monitor signals and respond to alerts | Basic | Real-time patient follow-up |
| Administrators | Manage user roles and records | Intermediate | Ensure data access control |
| Biomedical Engineers | Maintain device connectivity | Advanced | Ensure stable IoMT integration |
| Researchers | Analyze neonatal data | Advanced | Study health trends and model outputs |

### 2.4 Constraints

## This section outlines the key hardware, software, legal, and policy constraints that govern the development and deployment of the NICU Clinical Dashboard. All identified limitations are documented in accordance with the TOBB ETU Bitirme Projeleri Guideline (2025) and detailed within the submitted constraint assessment forms.

#### Hardware Constraints

* All NICU-connected IoMT devices shall operate under hospital electrical safety standards (IEC 60601-1). Leakage current ≤ 100 µA.
* All sensing modules must operate reliably between 18–26°C and humidity 40–60%, as per NICU standards.
* IoMT sensor modules attached to incubators shall weigh ≤ 200 g each to avoid structural imbalance.

#### Software Constraints

* Real-time data visualization latency shall not exceed 1 second between acquisition and display.
* All patient data must be encrypted at rest and in transit (AES-256 + HTTPS/TLS 1.3).
* System uptime shall be at least 99% during testing phase.
* AI inference for neonatal distress prediction must execute within ≤ 3 seconds per sample.
* Support for minimum 10 concurrent device streams via MQTT protocol.
* Incoming data packets must be verified using CRC or checksum validation before storage.
* All UI alert notifications must appear within ≤ 2 seconds and be color-coded for severity.
* AI model memory footprint shall not exceed 2 GB RAM during runtime.
* Software design and documentation must adhere to IEEE 1058 and ISO/IEC 12207 lifecycle standards.
* Use of real patient data requires anonymization and ethics board approval.

#### Temporal and Budgetary Constraints

## The total project duration is limited to 12 weeks.

## Only open-source tools and libraries will be used due to a zero-cost policy.

## Integration with physical medical devices will be postponed to the next project phase.

#### Document References

## All identified constraints and compliance validations are recorded in the following forms:

## Universal SW Constraint Tracking Form– [SW Constraints](https://docs.google.com/document/d/1hbv4x8GEEf3CDCwbx0djJnJPweZG8dzP/edit?usp=sharing&ouid=108700557094367383127&rtpof=true&sd=true)

## Cross-Discipline Constraint Tracking Form– [Cross Discipline Constraints](https://docs.google.com/document/d/1cvaduWG50F6i655-DW3G7gZVao6p0lcz/edit?usp=sharing&ouid=108700557094367383127&rtpof=true&sd=true)

## Both forms are committed to the project repository and uploaded to the shared Google Drive as part of the project documentation package.

## 2.5 Assumptions and Dependencies

* Data will be obtained from open-access PhysioNet databases (PICS-DB, MIMIC-IV) or generated synthetically.
* AI models will initially operate on pre-recorded or simulated data.
* Integration with real IoMT devices will occur in future iterations.
* Internet connectivity is assumed for real-time monitoring in demo mode.
* Institutional collaboration (Ertunç Özcan) will provide domain feedback and device standards.

## 3. Specific Requirements

## 3.1 Functional Requirements

**F-1 Real-Time Signal Monitoring**

| **ID** | **Requirement Description** |
| --- | --- |
| F-1.1 | The system shall display simulated physiological signal values in real time. |
| F-1.2 | The system shall update the signal display whenever new data is received. |
| F-1.3 | The system shall show a visual indicator when the data source connection is lost. |
| F-1.4 | The system shall highlight values that fall outside predefined thresholds. |
| F-1.5 | The system shall allow the user to pause and resume live monitoring. |
| F-1.6 | The system shall support configurable time windows for displayed graphs. |
| F-1.7 | The system shall mark missing or corrupted data points on the graph. |
| F-1.8 | The system shall auto-reconnect and resume data flow after temporary disconnect. |
| F-1.9 | The system shall maintain smooth graph performance under multi-patient load. |
| F-1.10 | The system shall reload the live graph automatically on page refresh. |

**F-2 AI Diagnostic Visualization**

| **ID** | **Requirement Description** |
| --- | --- |
| F-2.1 | The system shall retrieve diagnostic results from an AI or mock API endpoint. |
| F-2.2 | The system shall display diagnostic results within the patient dashboard. |
| F-2.3 | The system shall differentiate normal and abnormal diagnostic outcomes visually. |
| F-2.4 | The system shall show timestamp information for each diagnostic result. |
| F-2.5 | The system shall update diagnostic results when new data is available. |
| F-2.6 | The system shall display an error notification when the AI endpoint fails. |
| F-2.7 | The system shall store or cache the most recent diagnostic result. |
| F-2.8 | The system shall display simple text-based explanations of the diagnostic result. |
| F-2.9 | The system shall load previous diagnostic results when the patient page is opened. |
| F-2.10 | The system shall allow users to manually refresh diagnostic results. |

**F-3 Role-Based Access Control**

| **ID** | **Requirement Description** |
| --- | --- |
| F-3.1 | The system shall authenticate users before granting access. |
| F-3.2 | The system shall provide different access permissions for each user role. |
| F-3.3 | The system shall restrict administrative actions to authorized roles. |
| F-3.4 | The system shall block unauthorized users from accessing patient details. |
| F-3.5 | The system shall hide UI elements that the user’s role is not permitted to use. |
| F-3.6 | The system shall validate permissions for every protected backend endpoint. |
| F-3.7 | The system shall store user role data securely in the database. |
| F-3.8 | The system shall automatically expire sessions after inactivity. |
| F-3.9 | The system shall redirect unauthorized users attempting restricted actions. |
| F-3.10 | The system shall provide a secure logout mechanism. |

**F-4 Patient Record Management**

| **ID** | **Requirement Description** |
| --- | --- |
| F-4.1 | The system shall allow adding new patient records. |
| F-4.2 | The system shall allow updating existing patient records. |
| F-4.3 | The system shall allow archiving patient records. |
| F-4.4 | The system shall prevent editing of archived patient records. |
| F-4.5 | The system shall validate required fields during patient creation. |
| F-4.6 | The system shall display all patients in a searchable list. |
| F-4.7 | The system shall load a patient’s details when selected. |
| F-4.8 | The system shall enforce consistent formatting for patient information. |
| F-4.9 | The system shall allow filtering patients by basic attributes. |
| F-4.10 | The system shall prevent creation of duplicate patient records. |

**F-5 Alert and Notification System**

| **ID** | **Requirement Description** |
| --- | --- |
| F-5.1 | The system shall trigger alerts when monitored values exceed thresholds. |
| F-5.2 | The system shall display visual alerts on the dashboard. |
| F-5.3 | The system shall optionally play a sound for critical alerts. |
| F-5.4 | The system shall indicate which measurement triggered the alert. |
| F-5.5 | The system shall allow users to acknowledge alerts. |
| F-5.6 | The system shall clear alerts when values return to safe ranges. |
| F-5.7 | The system shall log the timestamp of each alert event. |
| F-5.8 | The system shall consolidate simultaneous alerts into a single notification. |
| F-5.9 | The system shall prevent repeated notifications for an unresolved alert. |
| F-5.10 | The system shall re-trigger alerts if the condition reoccurs after resolution. |

## 3.2 External Interface Requirements

| **Interface Type** | **Description** |
| --- | --- |
| User Interface | Web dashboard accessible via modern browsers (Chrome, Edge, Firefox). |
| Hardware Interface | Optional IoMT device integration via MQTT or simulated data streams. |
| Software Interface | RESTful API between frontend, backend, and AI module. |
| Communication Interface | Secure HTTPS and WebSocket protocols for real-time data. |
| Database Interface | PostgreSQL or MongoDB for patient signal and log data. |

## 3.3 Performance Requirements

| **Metric** | **Target** |
| --- | --- |
| Latency | Signal update delay ≤ 1 second |
| AI Inference Time | ≤ 2 seconds per evaluation |
| Concurrent Users | Minimum 10 concurrent users |
| Uptime | ≥ 95% during prototype testing |
| Data Throughput | Handle continuous data stream at 1Hz frequency |

## 3.4 Design Constraints

* Must adhere to IEEE 1058 (Project Management) and ISO/IEC/IEEE 29148 (Requirements) standards.
* Implement modular architecture separating data, AI, and UI layers.
* Use Python (Flask, TensorFlow) and JavaScript (React) as development languages.
* Follow HIPAA/GDPR principles for patient data handling.

## 3.5 Software System Attributes

This section evaluates the software quality of the system in accordance with the ISO/IEC 25010:2011 quality model. The following subsections describe the main quality attributes of the proposed system and how each will be achieved and maintained throughout development and deployment.

**NFR-1 Security**

| **ID** | **Requirement Description** |
| --- | --- |
| NFR-1.1 | The system shall store all user credentials securely. |
| NFR-1.2 | The system shall restrict access to patient data based on user roles. |
| NFR-1.3 | The system shall use secure communication protocols (HTTPS). |
| NFR-1.4 | The system shall prevent unauthorized API access. |
| NFR-1.5 | The system shall log all authentication attempts. |
| NFR-1.6 | The system shall protect stored patient information from unauthorized modification. |
| NFR-1.7 | The system shall enforce session expiration after inactivity. |
| NFR-1.8 | The system shall sanitize all user inputs to prevent injection attacks. |
| NFR-1.9 | The system shall restrict access to administrative functions. |
| NFR-1.10 | The system shall avoid storing sensitive information in client-side storage. |

**NFR-2 Performance Efficiency**

| **ID** | **Requirement Description** |
| --- | --- |
| NFR-2.1 | The system shall support at least 5–10 concurrent users during the prototype phase. |
| NFR-2.2 | The system shall load dashboard data within 2 seconds under normal conditions. |
| NFR-2.3 | The system shall process incoming real-time signal updates with <1s delay. |
| NFR-2.4 | The system shall maintain acceptable performance on standard laptop hardware. |
| NFR-2.5 | The system shall retrieve AI diagnostic results within reasonable response time. |
| NFR-2.6 | The system shall display trend graphs without noticeable lag. |
| NFR-2.7 | The system shall perform patient record queries efficiently. |
| NFR-2.8 | The system shall minimize redundant network calls where possible. |
| NFR-2.9 | The system shall keep CPU usage manageable during real-time graph updates. |
| NFR-2.10 | The system shall handle temporary API delays gracefully. |

**NFR-3 Usability**

| **ID** | **Requirement Description** |
| --- | --- |
| NFR-3.1 | The system shall provide an intuitive and clean user interface. |
| NFR-3.2 | The system shall allow users to navigate between dashboard sections easily. |
| NFR-3.3 | The system shall present alerts in a clear, visually distinguishable manner. |
| NFR-3.4 | The system shall support responsive layout for tablet-sized devices. |
| NFR-3.5 | The system shall provide readable icons, labels, and color indicators. |
| NFR-3.6 | The system shall allow users to understand data charts without external training. |
| NFR-3.7 | The system shall avoid cluttered or overwhelming visual layouts. |
| NFR-3.8 | The system shall clearly display user role information on login. |
| NFR-3.9 | The system shall use consistent UI components across all pages. |
| NFR-3.10 | The system shall provide confirmation messages for critical actions. |

**NFR-4 Reliability**

| **ID** | **Requirement Description** |
| --- | --- |
| NFR-4.1 | The system shall remain operational under normal network conditions. |
| NFR-4.2 | The system shall automatically reconnect to real-time data streams after interruptions. |
| NFR-4.3 | The system shall prevent system crashes caused by malformed data. |
| NFR-4.4 | The system shall recover smoothly after page refresh. |
| NFR-4.5 | The system shall display fallback messages when external services fail. |
| NFR-4.6 | The system shall maintain data consistency across UI components. |
| NFR-4.7 | The system shall handle heavy signal update frequency without freezing. |
| NFR-4.8 | The system shall ensure logs are recorded even during partial failures. |
| NFR-4.9 | The system shall protect against accidental data loss during updates. |
| NFR-4.10 | The system shall ensure stable functionality across supported browsers. |

**NFR-5 Maintainability / Portability**

| **ID** | **Requirement Description** |
| --- | --- |
| NFR-5.1 | The system shall have modular code structure for easier updates. |
| NFR-5.2 | The system shall separate frontend and backend responsibilities clearly. |
| NFR-5.3 | The system shall allow new signal types to be added with minimal modification. |
| NFR-5.4 | The system shall allow future integration with real NICU devices. |
| NFR-5.5 | The system shall allow future integration with HL7/FHIR if needed. |
| NFR-5.6 | The system shall allow diagnostic modules to be replaced or extended. |
| NFR-5.7 | The system shall support running in standard cloud environments. |
| NFR-5.8 | The system shall allow updating threshold values without code changes. |
| NFR-5.9 | The system shall keep configuration files centralized. |
| NFR-5.10 | The system shall allow UI components to be updated independently. |

## 4. Appendices

**4.1 Requirement Identification Schema**

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** | **Prefix** | **Example** | **Description** |
| Functional Requirement | F-XXX | F-001 | Defines a specific capability of the system. |
| Non-Functional / Quality Attribute | Q-XXX | Q-002 | Describes measurable system qualities such as reliability, security, or performance. |
| Constraint | C-XXX | C-003 | Defines technical or environmental limits such as hardware, legal, or timing constraints. |
| Test Case | T-XXX | T-001 | Specifies how each requirement will be verified. |

**4.2 Traceability Matrix**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Requirement ID** | **Description** | **Related Constraint** | **Quality Attribute (ISO/IEC 25010)** | **Verification Method** |
| F-001 | The system shall display live physiological signals (ECG, SpO₂, respiration) in real-time. | C-001 (Network latency ≤ 1s) | Performance Efficiency — Time Behaviour | Functional testing with simulated NICU stream |
| F-002 | The AI module shall classify respiratory and cardiac distress levels automatically. | C-002 (GPU memory ≤ 4GB) | Functional Suitability — Accuracy | Model validation and benchmark test |
| F-003 | The system shall provide user authentication and role-based access control. | C-003 (JWT-based security) | Security — Integrity, Confidentiality | Penetration testing, role-based access tests |
| F-004 | The dashboard shall generate clinical reports in PDF format. | C-004 (Export ≤ 3s) | Usability — Operability | Functional testing |
| Q-001 | The system shall maintain uptime ≥ 95% during operation. | C-005 (Server redundancy required) | Reliability — Availability | Stress testing and uptime monitoring |
| Q-002 | All data communication shall use HTTPS and AES-256 encryption. | C-006 (GDPR/KVKK compliance) | Security — Confidentiality | Security audit and data packet inspection |
| Q-003 | The dashboard shall respond to user input within 1 second. | C-007 (CPU load ≤ 70%) | Performance Efficiency — Resource Utilization | Load testing |
| Q-004 | The interface shall support both English and Turkish languages. | C-008 (Localization constraints) | Usability — Accessibility | UI testing |
| Q-005 | The system shall operate on both Windows and Linux environments using Docker. | C-009 (Cross-platform deployment) | Portability — Adaptability | Deployment validation test |

### 4.3 Traceability Chain Example

**Stakeholder Need → F-002 → C-002 → Q-001 → T-004**

**Explanation:**NICU clinicians require real-time AI-assisted distress classification (F-002).  
Hardware limitations (C-002) define acceptable model size and memory use.  
Reliability (Q-001) ensures stable model inference over long operation times.  
Verification occurs through Test Case T-004, evaluating inference time and consistency.

### 

### 4.4 Quality Attribute Mapping

|  |  |  |  |
| --- | --- | --- | --- |
| **ISO/IEC 25010 Quality Factor** | **System Feature or Module** | **Requirement IDs** | **Measurement Metric** |
| Performance Efficiency | Real-time data stream visualization | F-001, Q-003 | Latency ≤ 1s |
| Reliability | Fault-tolerant data handling | Q-001 | Uptime ≥ 95% |
| Security | Encrypted data transmission | F-003, Q-002 | AES-256, HTTPS |
| Usability | Clinician-friendly dashboard UI | F-004, Q-004 | User task completion time |
| Maintainability | Modular architecture, version control | — | Mean Time to Repair (MTTR) |
| Portability | Docker-based deployment | Q-005 | Multi-platform compatibility |
| Compliance | GDPR, HIPAA, KVKK adherence | C-006 | Compliance audit checklist |

**4.5 References Between Requirements and Test Cases**

|  |  |  |
| --- | --- | --- |
| **Requirement ID** | **Linked Test Case ID** | **Test Objective** |
| F-001 | T-001 | Verify real-time visualization accuracy |
| F-002 | T-002 | Validate AI inference within target latency |
| F-003 | T-003 | Confirm secure access and user role handling |
| Q-002 | T-004 | Validate data encryption and confidentiality |
| Q-005 | T-005 | Confirm containerized deployment on multiple OS |

### 4.6 Traceability Maintenance

All requirement IDs and test mappings are version-controlled using Git. Each modification triggers an automated update in the traceability table. The document follows the IEEE 29148 traceability principle:  
“Every requirement shall be uniquely identifiable, verifiable, and traceable across all project artifacts.”

## 5. References

*Goldberger, A. L., Amaral, L. A. N., Glass, L., Hausdorff, J. M., Ivanov, P. C., Mark, R. G., Mietus, J. E., Moody, G. B., Peng, C.-K., & Stanley, H. E. (2000). PhysioBank, PhysioToolkit, and PhysioNet: Components of a new research resource for complex physiologic signals. Circulation, 101(23), e215–e220. Retrieved from*[*https://physionet.org/content/*](https://physionet.org/content/)

*International Electrotechnical Commission (IEC). (2015). IEC 62304:2015 — Medical device software — Software life cycle processes. Retrieved from* [*https://webstore.iec.ch/publication/22786*](https://webstore.iec.ch/publication/22786)

*International Organization for Standardization. (2011). ISO/IEC 25010:2011 — Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — System and software quality models. Retrieved from* [*https://www.iso.org/standard/35733.html*](https://www.iso.org/standard/35733.html)

*International Organization for Standardization. (2018). ISO 26262:2018 — Road vehicles — Functional safety. Retrieved from* [*https://www.iso.org/standard/68383.html*](https://www.iso.org/standard/68383.html)

*International Organization for Standardization. (2022). ISO/IEC 27001:2022 — Information security, cybersecurity and privacy protection — Information security management systems. Retrieved from* [*https://www.iso.org/standard/82875.html*](https://www.iso.org/standard/82875.html)

*International Organization for Standardization & IEEE. (2018). ISO/IEC/IEEE 29148:2018 — Systems and software engineering — Life cycle processes — Requirements engineering. Retrieved from* [*https://www.iso.org/standard/72089.html*](https://www.iso.org/standard/72089.html)

*Open Web Application Security Project (OWASP). (2023). OWASP Top Ten Security Risks for Web Applications. Retrieved from* [*https://owasp.org/www-project-top-ten/*](https://owasp.org/www-project-top-ten/)

*PhysioNet. (2023). Neonatal Intensive Care Unit (NICU) vital signs dataset. Retrieved from* [*https://physionet.org/about/database/*](https://physionet.org/about/database/)

*Republic of Türkiye, Personal Data Protection Authority (KVKK). (2016). 6698 sayılı Kişisel Verilerin Korunması Kanunu. Retrieved from* [*https://www.kvkk.gov.tr/Icerik/6649/Kisisel-Verilerin-Korunmasi-Kanunu*](https://www.kvkk.gov.tr/Icerik/6649/Kisisel-Verilerin-Korunmasi-Kanunu)

*TÜBİTAK BİLGEM. (2023). Yapay Zekâ Sistemleri Güvenilirlik Rehberi. Retrieved from* [*https://bilgem.tubitak.gov.tr*](https://bilgem.tubitak.gov.tr)

*U.S. National Institutes of Health (NIH). (2020). Artificial Intelligence in Neonatal Intensive Care Units: Opportunities and Challenges. Retrieved from* [*https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7484551/*](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7484551/)

*World Health Organization (WHO). (2018). Preterm birth — Key facts. Retrieved from* [*https://www.who.int/news-room/fact-sheets/detail/preterm-birth*](https://www.who.int/news-room/fact-sheets/detail/preterm-birth)