MOFNet Clinical v3.0.0 - User Manual (Ultra-Full Reference)

Project: MOFNet – Multi-Organ Failure Network-Based Early Warning System
Version: 3.0.0
Author: Samir Baladi, MD
License: MIT

📄 Table of Contents

---

1. Introduction

MOFNet v3.0 is a **network-based early warning system** to detect multi-organ failure (MOF) in ICU patients using 8 physiological parameters.
It integrates:

- Real-time monitoring
- Network medicine approach
- Machine learning (ML) for early warning prediction

Objectives:
- Predict organ vulnerability
- Generate ePRI (enhanced Physiological Resilience Index)
- Support timely ICU interventions

---

2. System Requirements

Component	Requirement
OS	Windows 10+, Linux, Android 5+, PWA compatible browsers
RAM	≥1 GB
Storage	≥20 MB
Network	Optional (API access / cloud updates)
Python	3.9+ (for CLI/API)

```
---

## 3. Installation & Setup

### Options:

1. **PWA (Web App)** – [MOFNet Dashboard](https://mofnet.netlify.app/)
   - Offline support, auto-update

2. **Android APK**
   - Compatible with Android 5.0+, 1 GB RAM

3. **Python Package**
   ```bash
   pip install mofnet==3.0.0
   python interactive_cli_extended.py
```

Configuration:

- Default configuration files are located in `/config/`
- JSON or YAML format supported for ICU profiles

---

4. Dashboard & User Interface

Sections:

1. **Patient Overview** – ID, demographics, ICU location
2. **Vitals Panel** – HR, BP, RR, SpO_2, Temp, GCS, Urine Output
3. **Organ Network Visualization** – 8 nodes color-coded: stable, watch, failure
4. **ePRI Meter** – dynamic 0–1 scale
5. **Trend Analysis Graphs** – hourly/daily plots
6. **Alerts & Notifications** – on-screen, email, SMS

Color Codes:

Status	Color
Stable	Green
Watch	Yellow
Failure	Red
```

5. Clinical Protocols & ePRI

ePRI Score:

- **Stable:** ≥0.80
- **Watch:** 0.60–0.79
- **Failure:** <0.60

Intervention Triggers:

Trigger	Action
GCS drop >2 pts	Neurology consult
Urine output <30 ml/hr over 2h	Assess renal support
SpO_2 <92%	Oxygen therapy escalation
BP drop >20%	Hemodynamic support

---

6. Data Inputs & Parameter Definitions

Parameter	Normal Range	Units	Notes
HR	60–100	bpm	Optimal: 72
SBP	90–140	mmHg	Systolic
DBP	60–90	mmHg	Diastolic
RR	12–20	breaths/min	Optimal: 16
SpO_2	≥95	%	Pulse oximetry
GCS	3–15	score	Neurological status
Urine	≥30	ml/hr	Target ≥50 ml/hr

Parameter	Normal Range	Units	Notes
Output			
Temp	36.5–37.5	°C	Core body

Input Methods:

- Manual
- CSV / Excel upload
- HL7/FHIR interface
- API integration

---

7. Network Construction & Algorithms

Steps:

1. Preprocessing – normalize & filter data
2. Construct organ network (8 nodes: HR, BP, RR, SpO_2, GCS, UO, Temp, Composite)
3. Edge weight calculation – correlation & transfer entropy
4. Compute Node Vulnerability Index (NVI)
5. Compute ePRI

Python Example:

```
from mofnet.extended import build_network, compute_epri

network = build_network(patient_data)
epri_score = compute_epri(network)
print(f"ePRI: {epri_score}")
```

---

8. Node Vulnerability Index (NVI)

- Measures risk per organ node (0–1)
- Formula (simplified):

```
NVI = (HR_risk + BP_risk + RR_risk + SpO2_risk + GCS_risk + UO_risk +
Temp_risk) / 7
```

- Output used for **color-coded visualization** in dashboard

---

9. ePRI Calculation & Risk Levels

- **ePRI** = **avg(normalized physiological scores)**
- Risk Classification:

ePRI	Risk Level	Action
≥0.80	Stable	Routine monitoring
0.60–0.79	Watch	Increase observation, review trends
<0.60	Failure	Escalate care, intervention required

- Early Warning Lead: ~15 hrs before MOF onset

---

10. API Integration & Python Examples

REST API:

```
curl -X POST https://api.mofnet.app/v3/predict \
 -H "Authorization: Bearer YOUR_TOKEN" \
 -H "Content-Type: application/json" \
 -d '{"patient_id":"ICU-001","vitals":{...}}'
```

Python API Example:

```
from mofnet.extended import calculate_epri

epri = calculate_epri(
    hr=80,
    sbp=120,
    dbp=80,
    rr=16,
    spo2=98,
    gcs=15,
    urine_output=50,
    temperature=37
)
print(f"ePRI: {epri}")
```

---

11. Alerts, Notifications & Trend Analysis

- **Alert System:** threshold-based, color-coded
- **Notifications:** SMS, email, dashboard pop-ups
- **Trends:** hourly, daily, cumulative graphs
- **Export:** CSV / PDF / HL7

---

12. Security, Compliance & Logging

- **Encryption:** TLS 1.3, AES-256
- **Access Control:** MFA, RBAC
- **Session Timeout:** 30 min
- **Audit Logs:** Full, HIPAA/GDPR compliant
- **Regulations:** HIPAA, GDPR, HITECH, ISO 27001, 21 CFR Part 11

---

13. Troubleshooting & FAQ

Issue	Resolution
Installation fails	Check Python version ≥3.9
GCS input error	Must be 3–15 numeric
Urine output miscalculated	Check units (ml/hr)
Slow dashboard	Close background apps, ensure ≥1GB RAM
Network graph missing	Ensure valid vitals & no missing data

---

14. Updates, Migration & Versioning

- v2 → v3 migration: automatic, preserves previous ePRI
- Default values for new parameters: GCS=15, UO=50, Temp=37
- Backward compatible: 5-parameter PRI models

---

15. Roadmap & Future Development

- **v3.1:** iOS support, sepsis detection, multi-language UI
- **v3.2:** Pediatric ePRI, 10-parameter model
- **v4.0:** FDA submission, AR/VR interface, federated learning, AI clinical decision support

---

16. License & Disclaimers

- **License:** MIT
- **Disclaimer:** For research/clinical support only; not a substitute for professional judgment
- **Clinical Validation Required:** ePRI scores should be verified by clinicians before interventions

---

17. Acknowledgments

- **Author:** Samir Baladi, MD – AI & Critical Care
- **Contributors:** ICU clinicians, developers, beta testers
- **Website:** https://mofnet.netlify.app
- **GitHub:** @emerladcompass