

VigilCare Clinical — Roadmap Summary for Clinical Review

This document summarizes all planned changes to VigilCare's clinical monitoring system across two major initiatives: a **clinical scoring refactor** (based on your feedback) and a **climate resilience** architecture for ward-level reliability during network outages.

Part 1 — Clinical Scoring Refactor (Phases 25–29)

Based on your feedback, we're aligning the system with modern sepsis guidelines (Sepsis-3) and adding more granular consciousness assessment.

What's Changing

1. Replacing SIRS with Full SOFA for Sepsis Detection

Current system: Uses SIRS criteria (temperature, heart rate, respiratory rate, WBC count — 2 of 4 met = sepsis warning). As you noted, this is too non-specific — a patient with a mild cold or post-exercise can trigger it.

New system: Full SOFA score across six organ systems, each scored 0–4 (total 0–24):

Organ System	What We Measure	Score 0 (Normal)	Score 4 (Severe)
Respiratory	PaO2/FiO2 ratio (or SpO2/FiO2 if no ABG)	≥ 400	< 100 with ventilation
Coagulation	Platelet count	≥ 150 k/μL	< 20 k/μL
Liver	Bilirubin	< 1.2 mg/dL	> 12 mg/dL
Cardiovascular	MAP + vasopressor requirement	MAP ≥ 70, no pressors	High-dose pressors
Neurological	Glasgow Coma Scale	GCS 15	GCS < 6
Renal	Creatinine / urine output	Cr < 1.2 mg/dL	Cr > 5.0 or UO < 200 mL/day

Sepsis definition: A rise of ≥ 2 points from the patient's baseline SOFA score in the presence of suspected infection triggers a sepsis alert and activates the hour-1 treatment bundle (blood cultures, lactate, antibiotics, IV fluids).

Handling lab gaps: Lab values (platelets, bilirubin, creatinine, PaO2) aren't continuously available. The system carries forward the most recent value for up to 24 hours, and flags when data is getting stale (> 12 hours old) so clinicians know the score may be based on older labs. When no arterial blood gas is available (common on general wards), the system uses the SpO2/FiO2 ratio as a proxy for the respiratory component.

2. Adding Glasgow Coma Scale

Current system: Uses AVPU (Alert / Voice / Pain / Unresponsive) — a 4-level scale that loses significant clinical detail.

New system: Full GCS with three separately entered components:

Component	Scale	Labels
Eye Response (E)	1–4	No opening → Spontaneous
Verbal Response (V)	1–5	None → Oriented
Motor Response (M)	1–6	None → Obeys commands
Total	3–15	Computed from E + V + M

Why three separate inputs: A GCS of 9 from E2/V3/M4 tells a different clinical story than E3/V2/M4. The component breakdown is more informative for tracking which aspect of consciousness is changing.

GCS feeds into three systems:

- **SOFA** — neurological organ score (GCS 15 = 0, GCS 13–14 = 1, GCS 10–12 = 2, GCS 6–9 = 3, GCS < 6 = 4)
- **NEWS2** — consciousness parameter (GCS 15 = score 0, any GCS < 15 = score 3)
- **Standalone alerts** — GCS ≤ 8 triggers a critical alert; GCS 9–12 triggers a warning

The system still accepts AVPU for backward compatibility, but GCS is the preferred input going forward.

3. Keeping qSOFA as a Bedside Screening Tool

Current system: qSOFA ≥ 2 fires as a critical sepsis alert and triggers the treatment bundle — same weight as SIRS.

New system: qSOFA ≥ 2 creates a **screening recommendation** (warning level, not critical) that says: "qSOFA screen positive — recommend ordering SOFA labs (PaO₂/FiO₂, platelets, bilirubin, creatinine) to evaluate for organ dysfunction."

qSOFA no longer triggers the sepsis bundle directly. Only a confirmed SOFA delta ≥ 2 does.

The clinical workflow becomes:

```
Bedside screening (qSOFA ≥ 2)
↓
"Order SOFA labs" recommendation
↓
Labs return → SOFA score computed
↓
SOFA delta ≥ 2 from baseline → Sepsis confirmed → Hour-1 bundle activated
```

This matches the Sepsis-3 two-tier approach: quick bedside screen → lab-confirmed organ dysfunction.

4. Separating Deterioration Detection from Sepsis

The system has two independent deterioration engines that remain unchanged:

- **NEWS2** (National Early Warning Score 2) — 7-parameter composite score for general patient deterioration. Score ≥ 7 = emergency, score 5–6 = warning. This is the broad safety net.
- **Trend detection** — velocity-based alerting that catches rapid changes even when values are still in the normal range (e.g., heart rate rising from 72 to 95 in 30 minutes).

These are now cleanly separated from the sepsis engine. A patient can deteriorate without being septic (and vice versa).

What Stays the Same

- **Critical threshold alerts** — single-value breaches (e.g., potassium > 6.5 mEq/L) still fire immediately within the observation recording transaction. These are the fastest safety net.
 - **Sepsis bundle** — same four elements (blood cultures, serum lactate, antibiotics, IV fluids) with the same one-hour compliance deadline. Only the trigger changes (SOFA instead of SIRS).
 - **Alert acknowledgment and escalation** — same workflow. Unacknowledged critical alerts escalate after 5 minutes.
 - **NEWS2 scoring** — same 7 parameters, same risk levels. Only change: consciousness input prefers GCS over AVPU.
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New Data the System Will Need

These are the new observations the system will accept (in addition to the 12 it already tracks):

Observation	Unit	Typical Source	How Often
GCS Eye Response	1–4	Nurse assessment	Every 1–4 hours (neuro checks)
GCS Verbal Response	1–5	Nurse assessment	Every 1–4 hours
GCS Motor Response	1–6	Nurse assessment	Every 1–4 hours
PaO ₂	mmHg	ABG lab result	Every 4–12 hours (ICU)
FiO ₂	%	Ventilator / manual	With each O ₂ change
Platelet Count	k/ μ L	CBC lab result	Every 6–24 hours
Total Bilirubin	mg/dL	CMP/hepatic panel	Every 12–24 hours
Serum Creatinine	mg/dL	BMP/CMP lab result	Every 6–24 hours
Urine Output	mL/h	Nursing I&O	Every 1–4 hours

The cardiovascular SOFA component also reads vasopressor data from the medication administration record (drug name and dose for dopamine, dobutamine, epinephrine, norepinephrine).

Implementation Order

Phase	What Gets Built	Clinical Capability Added
25	GCS scoring engine	3-component consciousness assessment; feeds NEWS2 + qSOFA
26	Full SOFA scoring engine	6-organ-system scoring with baseline tracking and delta detection
27	Sepsis engine refactor	SIRS removed; qSOFA becomes screening; bundle triggered by SOFA
28	Dashboard updates	GCS entry form, SOFA display panel, updated alert labels
29	Scenario validation	Realistic patient scenarios testing the full pathway end-to-end

After these five phases, the system moves on to climate resilience (phases 20–24).

Part 2 — Climate Resilience: Ward Gateway Architecture (Phases 20–24)

This initiative addresses a real-world hospital problem: **what happens to patient monitoring when the network goes down?**

Currently, the entire system runs on a central server. If the connection between a ward and the server room is disrupted — construction, a storm, a router failure — the ward loses all clinical alerting. Nurses would have no automated safety net until connectivity is restored.

The Problem

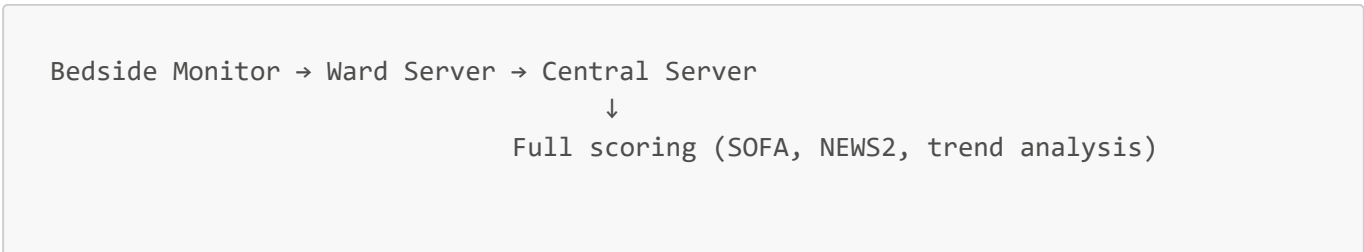
In a typical hospital deployment, bedside monitors and nurse workstations on the ward send data over the hospital network to a central server that runs all the scoring and alerting. This works well under normal conditions, but the network path from an ICU ward to the server room is a single point of failure. If that link goes down:

- Critical lab values (e.g., potassium 6.8 mEq/L) generate **no alerts**
- Nurses have no automated warning system
- All observations recorded during the outage are **lost** until someone notices

The Solution: A Local Ward Server

We place a small server on each ward (in the nurse station or equipment room) that can run independently when the central server is unreachable.

When the network is healthy (normal operation):



Sepsis bundle tracking Analytics and reporting

The ward server passes everything through to central. It's essentially transparent.

When the network is down (degraded mode):

```
Bedside Monitor → Ward Server (runs locally)
                  ↓
Critical threshold alerts (potassium, glucose, etc.)
Warning threshold alerts
Local paging to charge nurse
All data buffered for later sync
```

The ward server handles the most time-sensitive safety checks on its own. A nurse entering a potassium of 6.8 will still get an immediate critical alert, even if the central server is completely unreachable.

When the network comes back:

```
Ward Server → Central Server
              ↓
Buffered observations replayed
SOFA/NEWS2/trend catch up with correct timestamps
Alerts reconciled (no duplicate pages)
Audit trail complete – no gaps
```

All the data recorded during the outage syncs to central. The scoring engines (SOFA, NEWS2, trend) process the backlog with the original timestamps so the clinical timeline is accurate.

What Runs Locally vs. What Waits for Central

Capability	Runs on Ward Server?	Why
Critical threshold alerts (e.g., K+ > 6.5)	Yes	Life-safety — cannot wait for network
Warning threshold alerts (e.g., HR 105)	Yes	Important clinical awareness
Nurse paging + escalation	Yes (local)	Must work during outage
Observation recording	Yes (buffered)	No data loss
Alert acknowledge / resolve	Yes (local)	Nurses must be able to act
SOFA scoring	No — central only	Requires lab pipeline and multi-organ state

Capability	Runs on Ward Server?	Why
NEWS2 composite scoring	No — central only	Complex multi-parameter; catches up after sync
Trend / velocity detection	No — central only	Needs history window that spans outages
Sepsis bundle tracking	No — central only	Depends on SOFA and order management
Analytics and reporting	No — central only	Not time-critical

The trade-off is intentional: composite scores (SOFA, NEWS2) lag during an outage, but single-value critical breaches — the most immediately dangerous situations — still fire locally. A potassium of 6.8 doesn't need a composite score to be dangerous.

What the Dashboard Shows During an Outage

When the ward dashboard is connected to the local ward server instead of central:

- An **amber banner** appears: *"Central sync paused — ward operating in local mode. Alerts and documentation on this ward remain active."*
- Vital signs, critical/warning alerts, and acknowledge/resolve actions all work normally
- SOFA score, NEWS2 history, and sepsis bundle panels show *"Central connection required"*
- Once connectivity returns, the banner clears and full scoring catches up

Operations Visibility

Hospital IT staff get a fleet management view showing:

Gateway	Department	Status	Buffer	Last Sync
GW-ICU-3B	ICU	ONLINE	0	2 min ago
GW-ICU-1A	ICU	DEGRADED	847	45 min ago
GW-GM-8B	Gen Med	OFFLINE	1,240	3 hrs ago

This lets IT know which wards are operating in degraded mode and how much data is waiting to sync.

Implementation Order

Phase	What Gets Built	Clinical Capability Added
20	Site & gateway registry	Central server knows about each ward server; secure communication
21	Ward gateway service	Local observation recording, critical alerts, nurse paging during outage
22	Sync batch engine	Buffered data replays to central when network returns; no duplicates
23	Operations visibility	IT dashboard for fleet health; degraded mode banner for clinicians
24	Resilience verification	Chaos testing — intentionally break the network to prove it works

What the Hospital Needs to Provide

The ward gateway architecture requires:

- **A small server on each ward** (can be a mini PC or rack-mount) with UPS battery backup
- **Local network infrastructure** — the ward LAN must work independently of the uplink to the server room
- **Clinical policy** for local-only mode — who is responsible for escalation when composite scores are unavailable

The system handles everything else: automatic failover, data buffering, reconciliation, and audit trail preservation.

Overall Implementation Timeline

Order	Phases	Initiative	Summary
First	25–29	Clinical scoring refactor	SOFA replaces SIRS, GCS added, qSOFA becomes screening
Second	20–24	Climate resilience	Ward gateway keeps critical alerting alive during outages

Questions for Your Review

Clinical Scoring (Phases 25–29)

1. **SOFA baseline timing:** We establish the baseline SOFA when at least 4 of 6 organ systems have lab data. Does this threshold make clinical sense, or should we require all 6?
2. **Lab staleness window:** We carry forward lab values for up to 24 hours before considering them expired. Is 24 hours reasonable for ICU patients? Should it differ for ward patients?
3. **SpO2/FiO2 fallback:** When no ABG is available, we use SpO2/FiO2 as a proxy for the respiratory SOFA component. Are you comfortable with this approximation for ward-level monitoring?
4. **GCS alert thresholds:** We alert at $GCS \leq 8$ (critical) and $GCS 9-12$ (warning). Do these cutoffs match your clinical expectations?
5. **qSOFA screening level:** We changed qSOFA from CRITICAL to WARNING severity. Should a positive qSOFA screen still page the physician, or just appear on the dashboard for the next review?

Climate Resilience (Phases 20–24)

6. **Local-only scoring scope:** During a network outage, the ward server runs critical and warning threshold alerts only (e.g., potassium > 6.5, heart rate > 150). Composite scores (SOFA, NEWS2) wait for central to catch up after reconnection. Is this acceptable, or are there specific composite alerts you'd want running locally?

7. **Degraded mode clinical policy:** When the ward is in local-only mode, composite scores are unavailable. Should the system display a specific clinical guidance message (e.g., "Increase manual assessment frequency") or just indicate that scoring is offline?
8. **Sync reconciliation:** When buffered data syncs back to central, the scoring engines replay everything with the original timestamps. Is there clinical value in flagging these "retroactively computed" scores differently from real-time ones?