

Vital bulgular izleminde dijital sistemler: Kritik hastalarda klinik bozulmayı algılayan sensör teknolojileri

Dr. Öğr. Üyesi Mehmet Oğuzhan AY
Hitit Ün. Tıp Fak. Acil Tıp A.D.

Klinik Bozulma Tespitinde Vital Bulgu Takibi

- Özellikle 1990'lı yıllardan sonra yapılan araştırmalar, hastaların vital bulgularında ve şuurunda olan değişikliklerin atlanmasının hastalarda tedavinin gecikmesine ve klinik bozulmaya yol açabileceğini göstermiştir.
- Bu gözlemler sonucunda skarlama sistemleri geliştirilmiştir.
- Belirli kriterleri sağlayan hastalar için klinik bozulmayı engellemek amaçlı hızlı müdahale ekipleri kurulmaya başlanmıştır.
- Sensör ve bilgisayar teknolojilerinin gelişmesi, kablosuz erişimli tıbbi cihazların yaygınlaşması ile vital bulgarı daha önceden belirlenmiş eşik değerleri aşan riskli hastalar bilgisayarlarca tespit edilip hemşire ve hekimler erkenden uyarılmaya başlanmıştır.

McGaughey J, Alderdice F, Fowler R, Kapila A, Mayhew A, Moutray M. Outreach and Early Warning Systems (EWS) for the prevention of intensive care admission and death of critically ill adult patients on general hospital wards. *Cochrane Database Syst Rev.* 2007;3.

ECRI Institute. *Low-Acuity Continuous Monitoring: An Introduction*: ECRI 2014.

Jones DA, DeVita MA, Bellomo R. Rapid-response teams. *New England Journal of Medicine.* 2011;365(2):139-146.

Klinik Bozulma Tespitinde Vital Bulgu Takibi

- **Geleneksel Yöntemler**
 - Standart hemşire kontrollü
 - Kalp ve solunum hızı, ateş, saturasyon, tansiyon, bilinç durumu, aldığı çıkardığı takibi
 - Klinik bozulmayı tespit eden skorlama sistemleri
 - The Early Warning Scoring Systems (EWS),
 - Modified EWS (MEWS),
 - The National EWS (NEWS),
 - NEWS 2
 - Sepsisli hastalarda Quick SOFA

National Early Warning Score (NEWS)

Chart 1: The NEWS scoring system

Physiological parameter	Score						
	3	2	1	0	1	2	3
Respiration rate (per minute)	≤8		9–11	12–20		21–24	≥25
SpO ₂ Scale 1 (%)	≤91	92–93	94–95	≥96			
SpO ₂ Scale 2 (%)	≤83	84–85	86–87	88–92 ≥93 on air	93–94 on oxygen	95–96 on oxygen	≥97 on oxygen
Air or oxygen?		Oxygen		Air			
Systolic blood pressure (mmHg)	≤90	91–100	101–110	111–219			≥220
Pulse (per minute)	≤40		41–50	51–90	91–110	111–130	≥131
Consciousness				Alert			CVPU
Temperature (°C)	≤35.0		35.1–36.0	36.1–38.0	38.1–39.0	≥39.1	

National Early Warning Score (NEWS)

Chart 2: NEWS thresholds and triggers

NEWS score	Clinical risk	Response
Aggregate score 0–4	Low	Ward-based response
Red score Score of 3 in any individual parameter	Low–medium	Urgent ward-based response*
Aggregate score 5–6	Medium	Key threshold for urgent response*
Aggregate score 7 or more	High	Urgent or emergency response**

* Response by a clinician or team with competence in the assessment and treatment of acutely ill patients and in recognising when the escalation of care to a critical care team is appropriate.

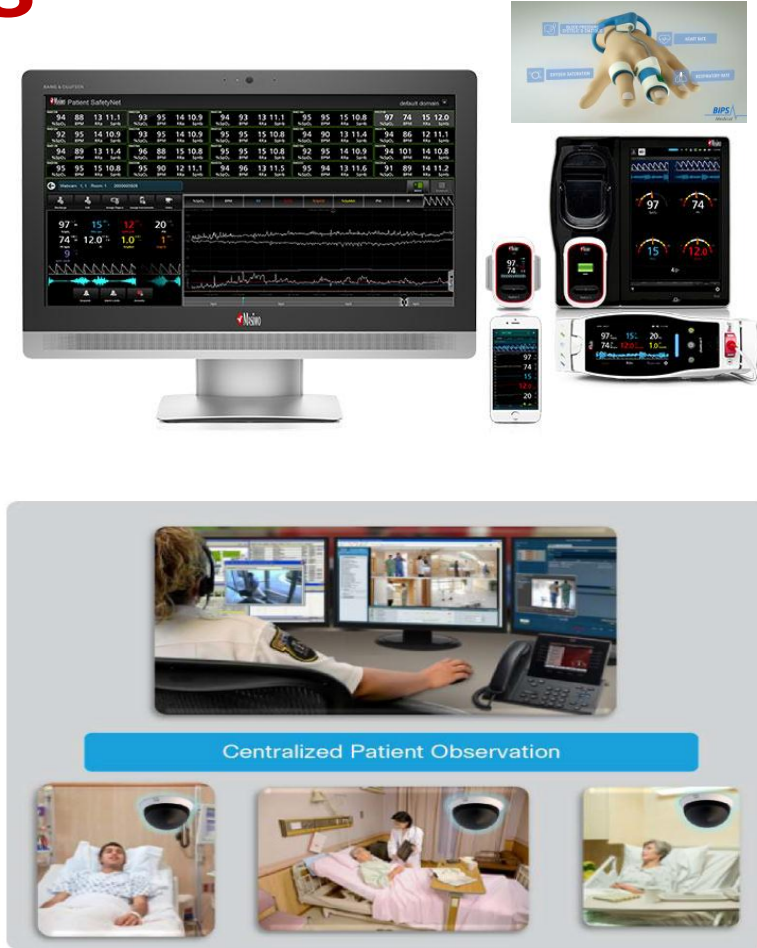
**The response team must also include staff with critical care skills, including airway management.

Chart 4: Clinical response to the NEWS trigger thresholds

NEWS score	Frequency of monitoring	Clinical response
0	Minimum 12 hourly	Continue routine NEWS monitoring
Total 1–4	Minimum 4–6 hourly	- Inform registered nurse, who must assess the patient - Registered nurse decides whether increased frequency of monitoring and/or escalation of care is required
3 in single parameter	Minimum 1 hourly	Registered nurse to inform medical team caring for the patient, who will review and decide whether escalation of care is necessary
Total 5 or more Urgent response threshold	Minimum 1 hourly	- Registered nurse to immediately inform the medical team caring for the patient - Registered nurse to request urgent assessment by a clinician or team with core competencies in the care of acutely ill patients - Provide clinical care in an environment with monitoring facilities
Total 7 or more Emergency response threshold	Continuous monitoring of vital signs	- Registered nurse to immediately inform the medical team caring for the patient – this should be at least at specialist registrar level - Emergency assessment by a team with critical care competencies, including practitioner(s) with advanced airway management skills - Consider transfer of care to a level 2 or 3 clinical care facility, ie higher-dependency unit or ICU - Clinical care in an environment with monitoring facilities

Klinik Bozulma Tespitinde Sürekli Vital Bulgu Takibi

- Telemetri sistemleri
 - Giyilebilir sensörler
 - Temassız kablosuz sensörler
 - Hareket sensörleri
 - Video ve ses takip sistemleri
 - Yatakbaşı ve merkezi monitörler
- Mortalite, ventilatöre bağlı kalma ve taburculuk sürelerinde ciddi azalma

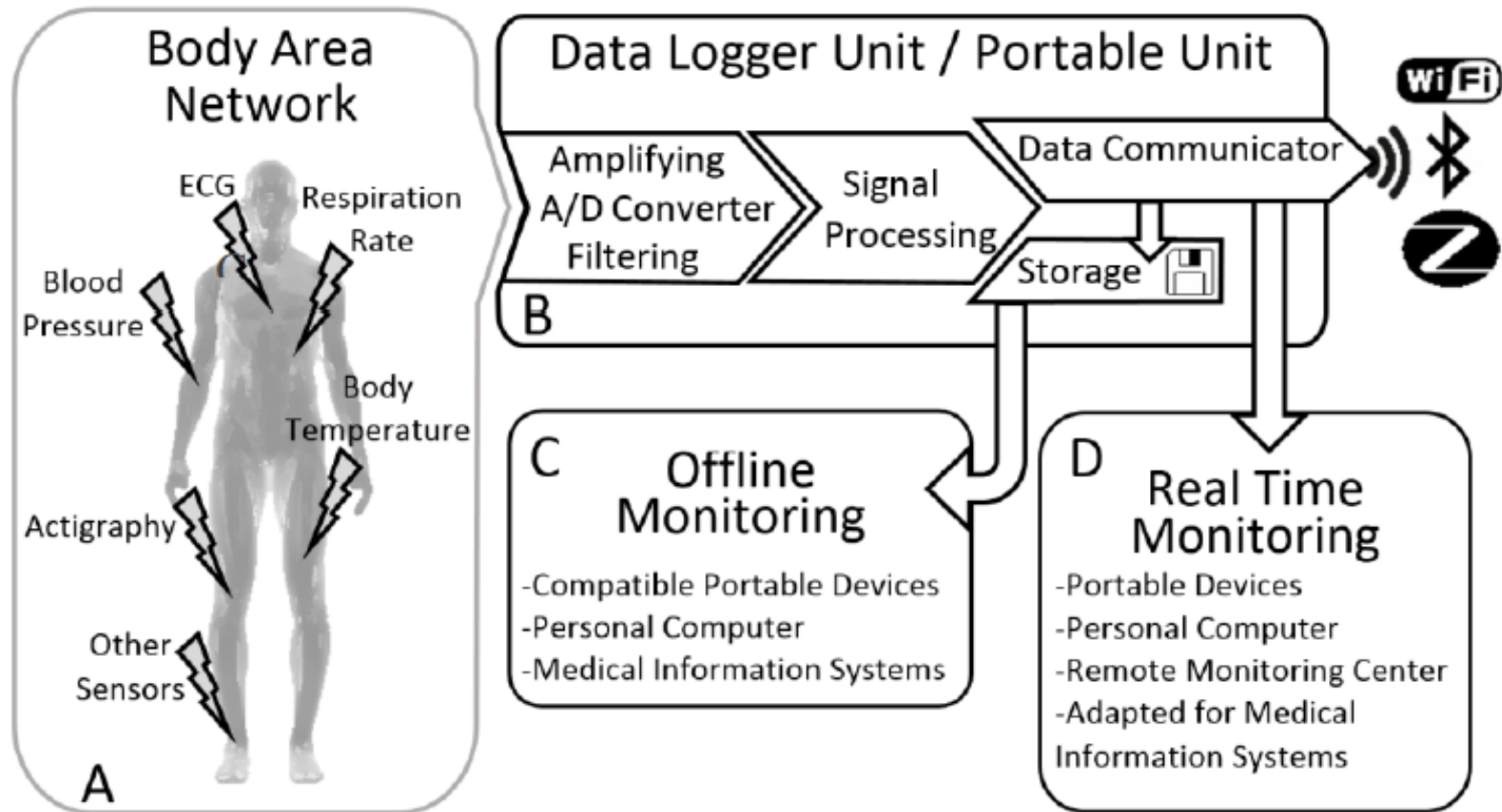


Breslow MJ: Remote ICU care programs: Current status. *J Crit Care* 2007,22:66-76.

Breslow MJ, et al. Effect of a multiple-site intensive care unit telemedicine program on clinical and economic outcomes: An alternative paradigm for intensivist staffing. *Crit Care Med* 2004, 32:31-38.

Telemetrik Takip

- Kalp hızı
- Tansiyon
- Solunum hızı
- Vücut ısısı
- Pulsoksimetri
- Kalp sesleri
- EKG
- Fiziksel aktivite
- EEG
- EMG
- Spirometri
- Oksijen tüketimi
- CO2 üretimi
- Kan glukozu, laktat düzeyi
- Bazal metabolik hız



Sürekli Vital Bulgu Monitorizasyonu

Device	Vital signs	Technology	Transducer	Sampling location	Connectivity	Ergonomics ^a
Pulse oximeter	SpO ₂ , HR, RR	Photoplethysmography	(1) Transmittance (2) Reflectance	(1) Digit, ear, nasal alae (2) Forehead, chest	(3) Not attached (4) Wireless (Bluetooth, WiFi)	(3) B (4) A—
Capnograph	ETCO ₂ , RR	IR spectography	Nasal cannula	Mouth/nose	Attached	C
Airflow detector	RR	Humidity detector, thermistor	Face mask, nasal transducer	Mouth/nose	Attached	C
Impedance plethysmography	RR, tidal volume	Transthoracic impedance	Electrodes, strain gauges	Chest wall	Attached	B
Bioacoustics	RR	Large airway audio (breath) detection	Microphone	Neck	Attached	B
Piezoelectric	HR, RR	Piezoelectrics	Piezoelectric element	Under mattress	Hardwired to mattress	A
cNIBP	SBP, DBP, MBP	Pulse transit time	Photoplethysmograph, electrodes	Wrist	Wireless	A—
Patch (Wearable)	ECG, RR, HR	Accelerometry, electrical impedance	Accelerometer, electrodes	Chest wall	Wireless (Bluetooth, WiFi)	A

cNIBP, continuous noninvasive blood pressure; ETCO₂, end-tidal CO₂; HR, heart rate; RR, respiratory rate. ^a (A) High patient acceptance due to small transducer not attached to bedside device. (B) Larger transducer ($\pm$ adhesive) attached to bedside device. (C) Facial transducer often encumbering for awake patients and attached to bedside device.

[Vincent JL](#) et al. Improving detection of patient deterioration in the general hospital ward environment. *Eur J Anaesthesiol.* 2018 May;35(5):325-333.





The ViSi Mobile System Monitors:

	Continuous Non-Invasive Blood Pressure*		SpO2
	Heart Rate		Pulse Rate
	Respiration Rate		Skin Temperature
	ECG		Life Threatening Arrhythmias*
	Posture		Fall Detection





BLOOD PRESSURE
SYSTOLIC & DIASTOLIC



HEART RATE



OXYGEN SATURATION

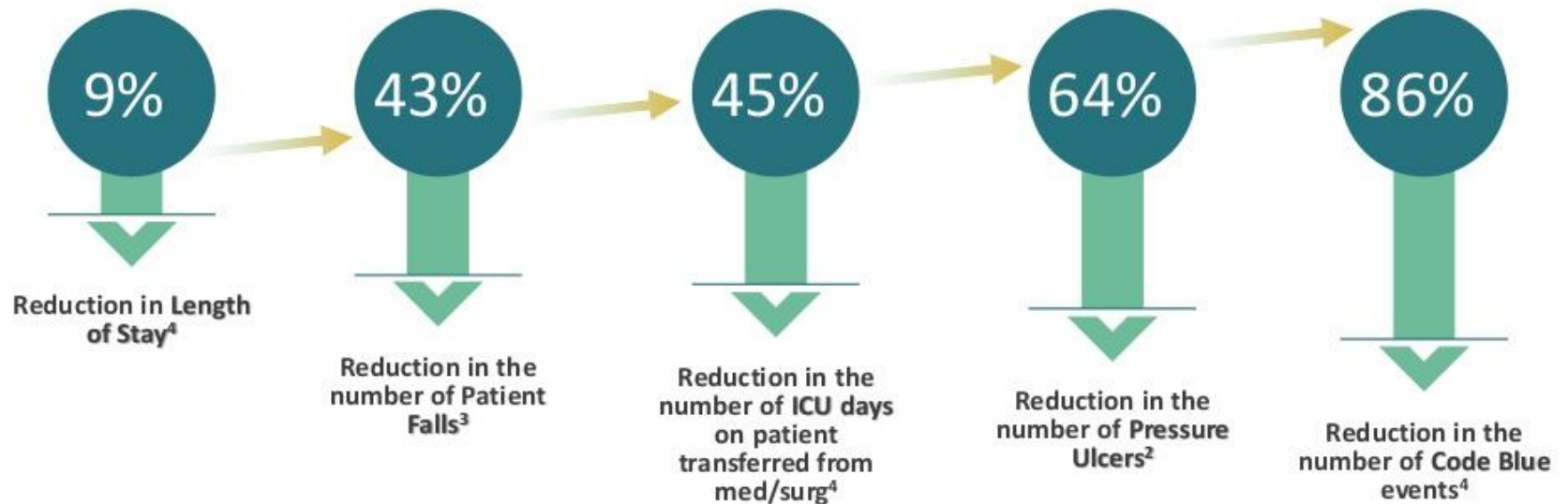


RESPIRATORY RATE





The Implementation of The EarlySense Solution is Reported by Hospitals to Reduce These Critical Parameters: data collected in 10 hospitals on over 10,000 patients. Sample results:



1. Based on 7,643 Patients' Clinical Trial
2. Slight, SP et al, Society of General Internal Medicine

3. April 2013. 3. Pallace, ZJ et al, AGS. May 2013
4. Zimlichman, E et al, ATS. 2012

[illegible]