



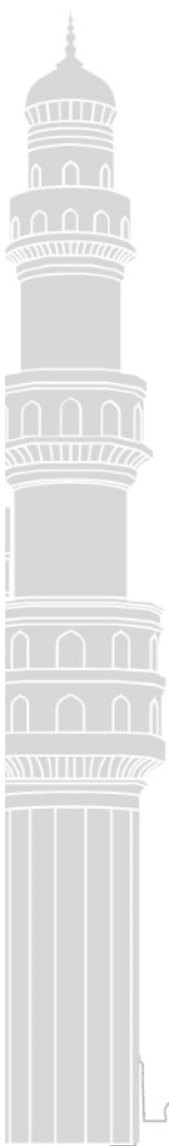
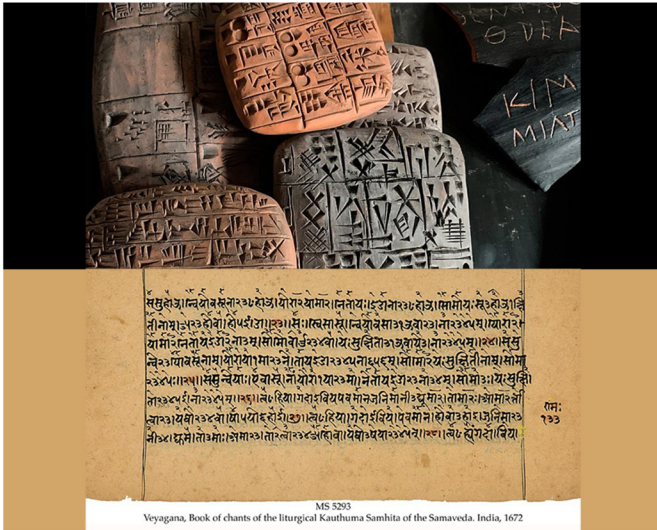
Wearable Vital Monitoring Solution to Improve Patient Care

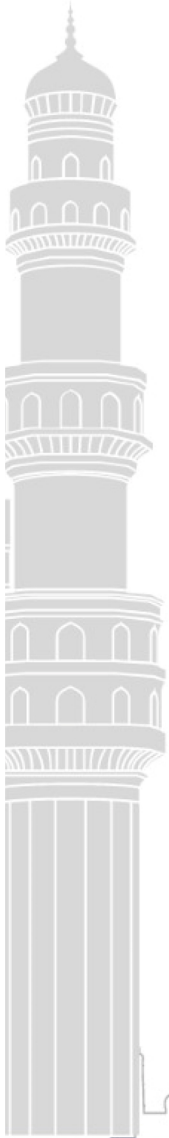
The Kauvery Experience

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When did human civilisation begin ?





Our Experience

Patient Group

Patients stepping down from ICU to wards – all medical and surgical except cardiac and cardiothoracic

Study type

Before and after study Observational study design used to assess effect of an intervention based on comparison of outcomes prior to it's use and afterwards

Outcomes

Cardiac arrests / Code Blues per month

Additional interventions

Hospital wide wifi capability with additional routers. dedicated PC dashboard, dedicated mobile for alerts, 24 x7 ANM cover

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Time Period

3 months April, May and June 2022

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Intervention

Wearable biosensor patch – “Life Signs”, a CE and FDA approved wearable device with factory pre sets for abnormal values

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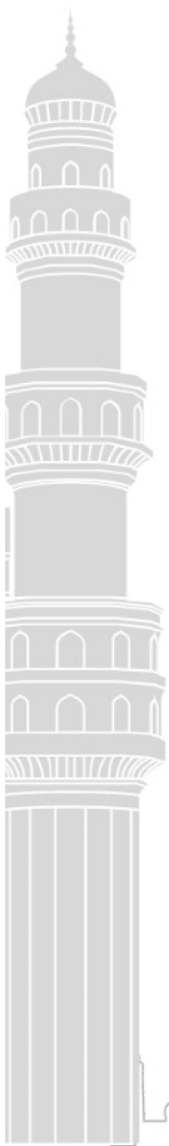
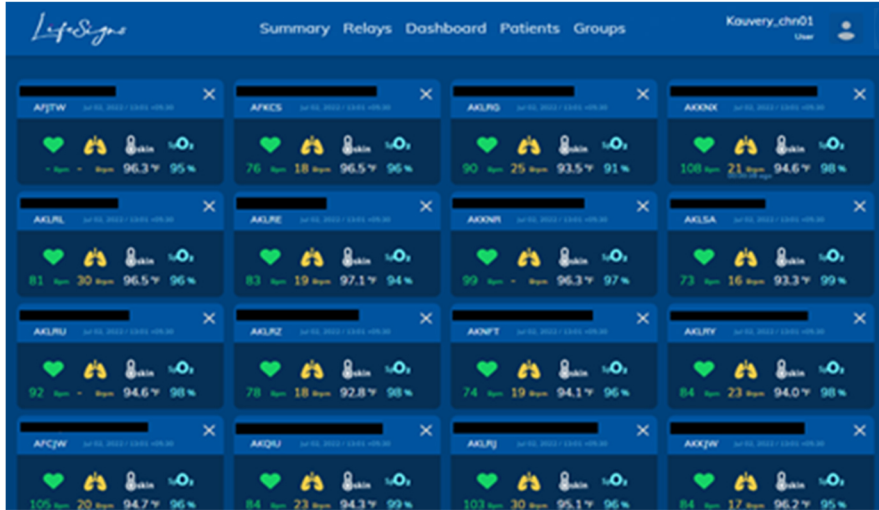
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Vital signs measured

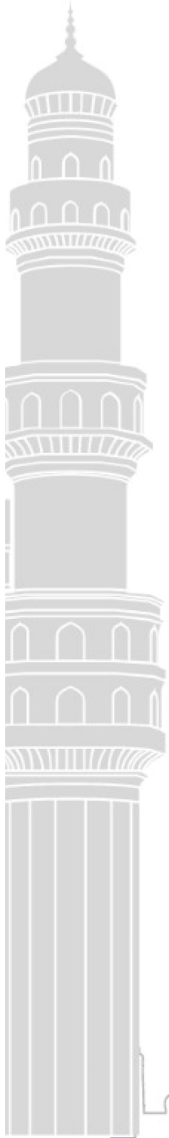
Heart rate, respiratory rate, skin temperature, Oxygen saturation, pulse rate

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You can choose to insert any additional pictures/graphs/tables or any other additional information



Parameters	April	May	June
Total no. of patients on wireless patch monitoring	87	67	70
Total no. of patients transferred to ICU	5	4	3
Return to ICU within 48 hour (critical transfers)	2	1	0
No. of MEAT Call	11	12	9
No. of Code Blue	0	0	0
Total no. of patches	109	72	72



Parameters Vitals



Heart Rate



2-Channel ECG



Temperature



Respiration Rate



SpO₂



Posture



Blood Pressure



Pulse Rate

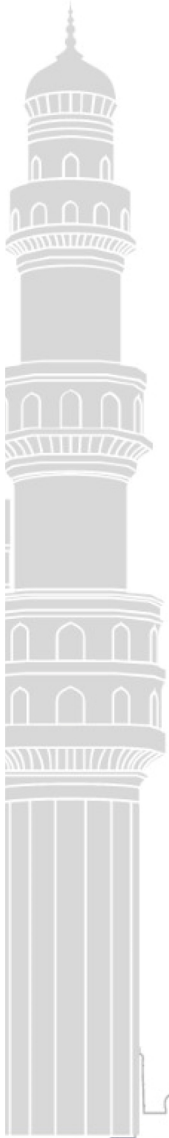


Table 1 Characteristics of the included studies

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Source	Country	Population	Sample size	Interventions		Vital signs measured by WMS					Age (years)		Sex (% male)	
				Control (EWS)	WMS	HR	RR	SpO2	BP	T	Control	WMS	Control	WMS

Included studies and outcomes

Meta-analysis

Skraastad et al. 2019	Norway	General surgery	195	Intermittent vital signs (NEWS)	PSE (NEWS) + ESS	x	x	x	x	x	62	61	63%	63%
Downey et al. 2020	UK	General surgery	135	Intermittent vital signs (NEWS)	SensiumVitals + NEWS	x	x			x	62	65	54%	52%
Downey et al. 2018	UK	General surgery	226	Intermittent vital signs (NEWS)	SensiumVitals + NEWS	x	x			x	63.7	65.2	45%	54%
Kisner et al. 2009	Switzerland	General surgery	357	Intermittent vital signs (Unknown)	Auricall	x		x			62.7	65	75%	75%
Weller et al. 2018	USA	Neurology and neurosurgery	1958	Intermittent vital signs (Unknown)	VisiMobile	x	x	x	x	x	59.3	60.5	58%	54%
Verrillo et al. 2018	USA	Orthopaedic, spinal and trauma general care	849	Intermittent vital signs (Unknown)	VisiMobile	x	x	x	x	x	51.4	54.5	58%	54%
Watkinson et al. 2020	UK	Gastro intestinal surgery	407	Intermittent vital signs (CEWS)	Avant-4100	x		x			63	63	56%	58%

Narrative

Weenk et al. 2019	Netherlands	Surgical and internal medicine ward	60*	Intermittent measurement (MEWS)	VisiMobile	x	x	x	x	x	N/A	63	N/A	60%
					HealthPatch	x	x			x	N/A	56	N/A	73.3%
Weenk et al. 2020	Netherlands	Surgical and internal medicine ward	90*	Intermittent measurement (MEWS)	VisiMobile	x	x	x	x	x	62	63	67%	60%
					HealthPatch	x	x			x	56		73.3%	
Monson et al. 2020	USA	Labour and delivery ward	216	Standard external monitoring	Monica Novii	x**					28.6	29.2	0%	0%

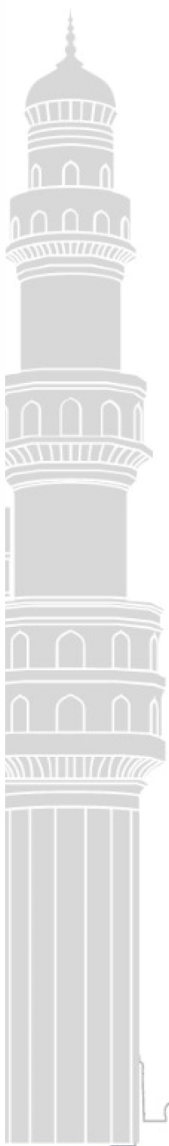
WMS: wearable monitoring system. BP: blood pressure, CEWS: centile-based early warning score, ESS: efficacy safety score, EWS: early warning Score, HR: heart rate, NEWS: national early warning score, PSE: Patient Status Engine, RR: respiratory rate, SpO2: peripheral oxygen saturation, T: temperature, x: device measures that vital sign. *Same patients. Weenk et al. 2020 Added 30 controls. **Both maternal and fetal heart rate

Table 3 Vital sign thresholds summary table

Study	Vital sign thresholds (delay before alarm in seconds)								Alarm method	
	HR/PR		RR		SpO2	BP		MAP		T
	High	Low	High	Low	Low	High SBP	Low DBP	Low		
Weller et al. 2018	HR: 150 (15) PR: 150 (60)	HR: 39 (15) PR: 39 (60)	35 (120)	4 (120)	85 (90)	200 (240)		58 (60)	Sound Central station + nurse phone	
Kisner et al. 2009	Individualised (immediate)				Pre-set individualised (immediate)				Sound Pager or SMS to doctor and nurse	
Verrilo et al. 2018	Pre-set (5)		Pre-set (120)		Pre-set (60)	Pre-set (120)			Sound Central monitor + nurse mobile	
Downey et al. 2018	Pre-set, individualised if required (immediate)		Pre-set, individualised if required (immediate)				Pre-set, individualised if required (immediate)		Sound Mobile device to nurse	
Downey et al. 2020	Pre-set, individualised if required (immediate)		Pre-set, individualised if required (immediate)				Pre-set, individualised if required (immediate)		Sound Mobile device to nurse	
Weenk et al. 2019 & 2020	Individualised (immediate)		Individualised (immediate)		Individualised (immediate)	Individualised (immediate)		Individualised (immediate)	Sound Nurse station	
Skraastad et al. 2020	As per NEWS score		As per NEWS score		As per NEWS score	As per NEWS score		As per NEWS score	Visual only Warnings at patient bedside	

Score name	Alerting score thresholds					Time to alarm	Alarm method
	Vital signs included in score	Range	Threshold				
Watkinson et al. 2020	VSI	All	0 to 5	> 3.0 for more than 4 out of 5 min	On the fifth minute		Sound Bedside + central station + nurse PDA

BP: blood pressure, DBP: diastolic blood pressure, HR: heart rate, MAP: mean arterial pressure. PDA: personal digital assistant, PR: pulse rate, RR: respiratory rate, SBP: systolic blood pressure, SMS: short message service, SpO2: Peripheral oxygen saturation, T: temperature, VSI: Visensia Safety Index



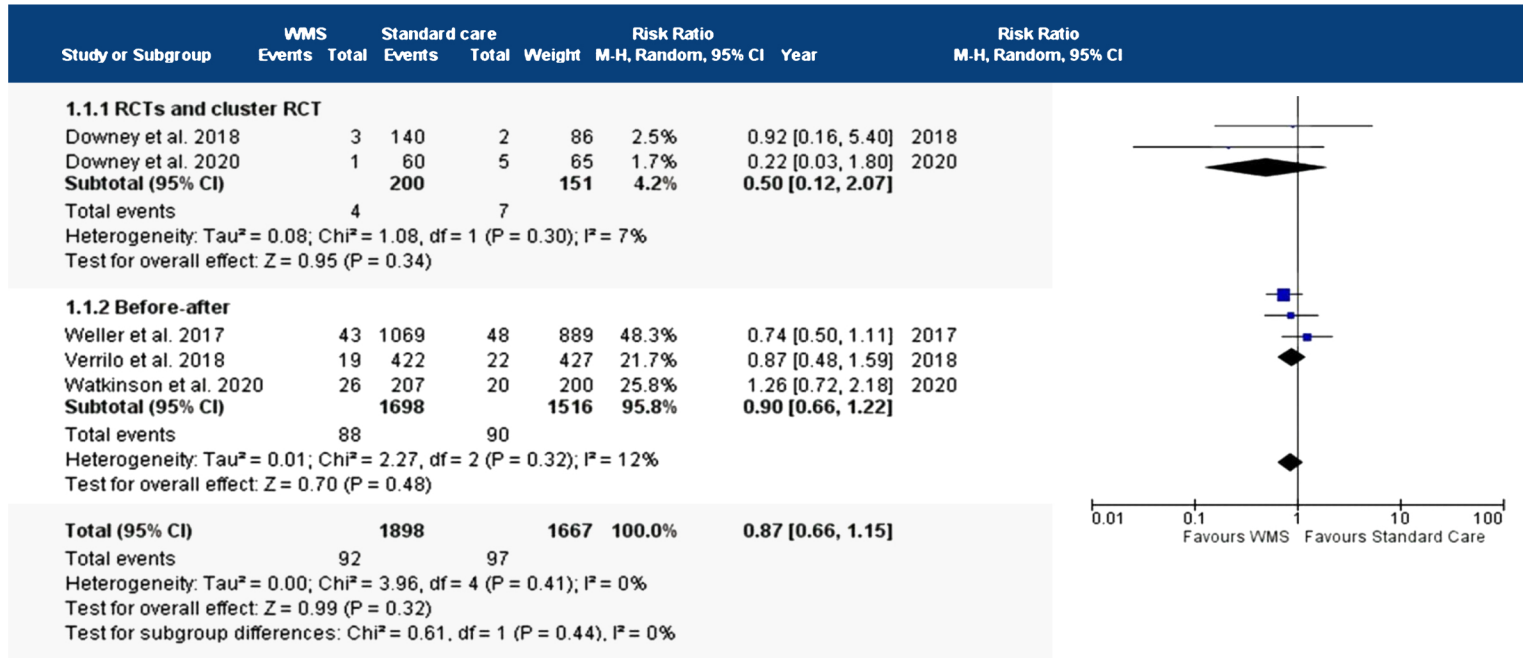


Fig. 3 Meta-analysis forest plots comparing WMS and standard care ICU transfer risk ratio. WMS: wearable monitoring systems, CI: confidence intervals, M-H: Mantel–Haenszel, RCT: randomised controlled trial

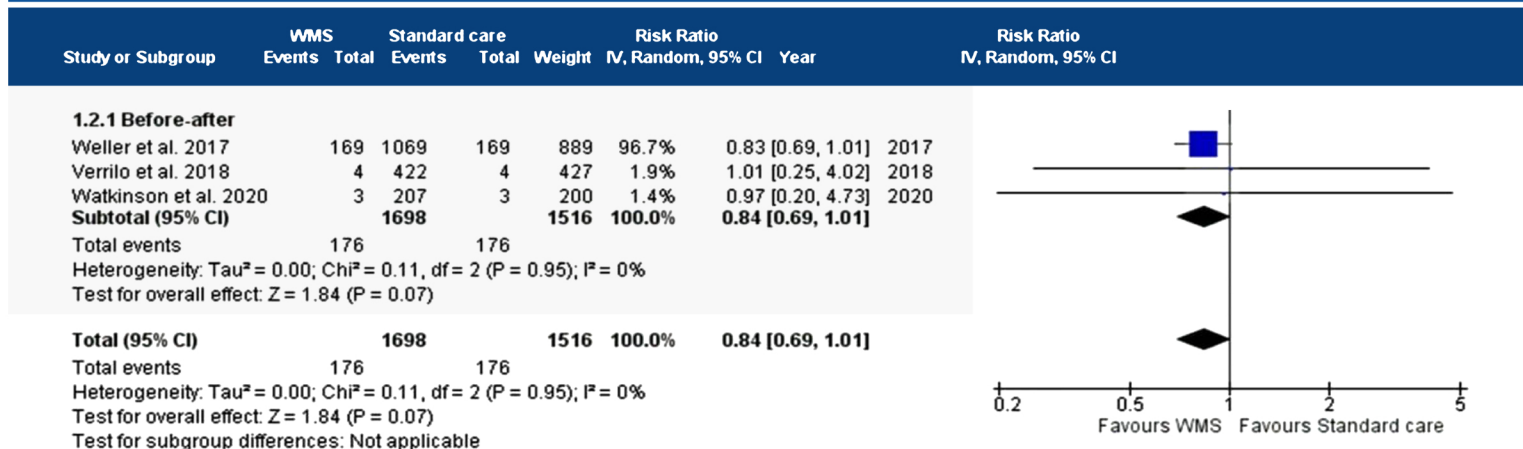


Fig. 4 Meta-analysis forest plots comparing WMS and standard care rapid response or cardiac arrest team activation risk ratio. WMS: wearable monitoring systems, CI: confidence intervals, M-H: Mantel–Haenszel

Summary

Emerging area of research with hardly any Indian studies

Benefit likely to be higher in high risk populations

AI will undoubtedly play a role in future in prediction as well as detection

Not just cardiac arrests, length of stay in hospital and ICU, ICU and hospital readmission rates, sepsis detection and time to antibiotic administration, time to post operative mobilisation, home monitoring etc

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Signal for benefit

Beware alarm fatigue

Integration with other electronic medical information - blood results and imaging



Thank You

