Έγκαιρη αναγνώριση της επιδείνωσης του αναπνευστικού ασθενούς στο τμήμα Εργαλεία πρόγνωσης στην κλινική πράξη

Μ. Ντάγανου
ΜΕΘ Α’Π/Π ΝΝΘΑ

Οξέα ανεπιθύμητα συμβάματα σε νοσηλευόμενους ασθενείς εκτός ΜΕΘ

καρδιοαναπνευστική ανακοπή

απροσχεδίαστη εισαγωγή στη ΜΕΘ

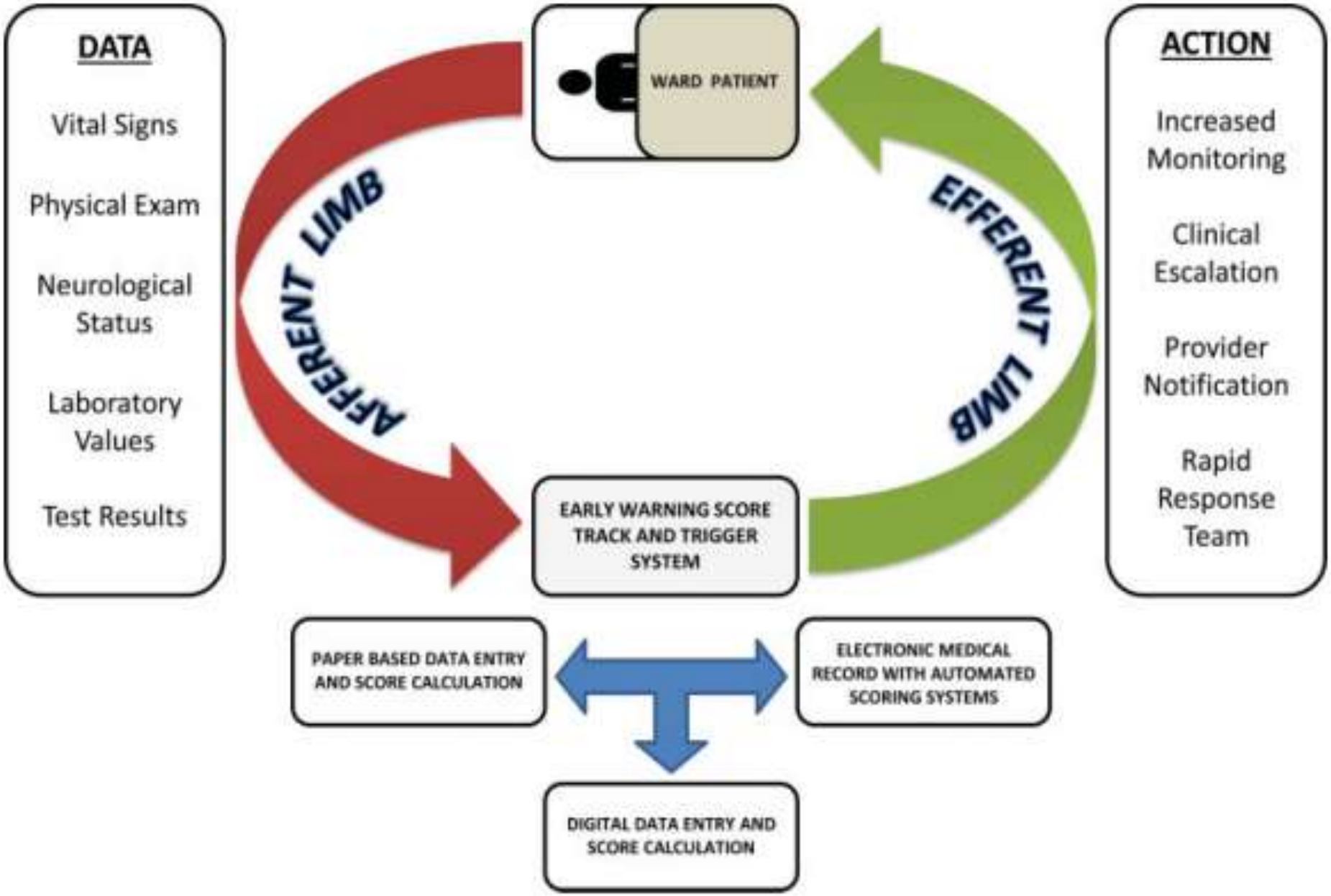
μη αναμενόμενος θάνατος

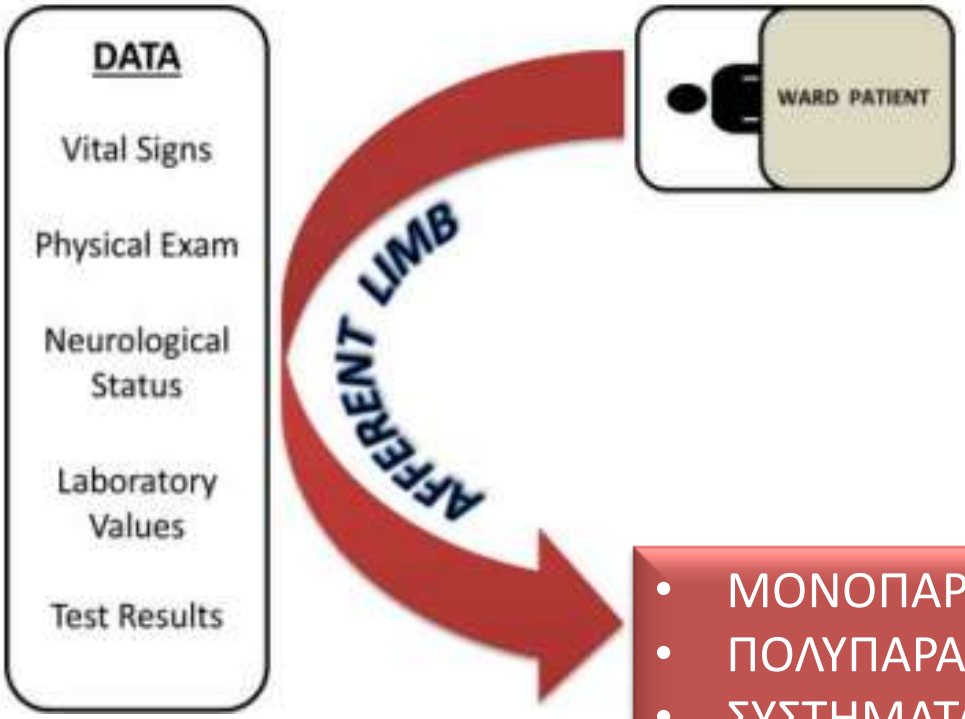
Σε > 80% των περιπτώσεων ανιχνεύσιμα σημεία κλινικής επιδείνωσης προηγούνται μέχρι και 48 ώρες

Η έγκαιρη αναγνώριση αυτών των σημείων και η παρέμβαση πριν την εμφάνιση του συμβάματος μπορεί να βελτιώσει την πρόγνωση

TRACK AND TRIGGER – RAPID RESPONSE SYSTEMS

Semin Respir Crit Care Med 2016;37:88



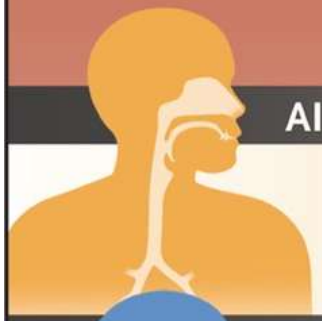


- ΜΟΝΟΠΑΡΑΓΟΝΤΙΚΑ ΣΥΣΤΗΜΑΤΑ
- ΠΟΛΥΠΑΡΑΓΟΝΤΙΚΑ ΣΥΣΤΗΜΑΤΑ
- ΣΥΣΤΗΜΑΤΑ ΣΤΑΘΜΙΣΜΕΝΗΣ ΒΑΡΥΤΗΤΑΣ

if you are worried about any patient

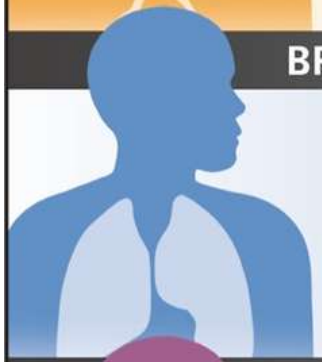
OR

if you notice any acute changes in



AIRWAY

- Obstructed airway
- Noisy breathing or stridor
- Problem with a tracheostomy tube



BREATHING

- Any difficulty breathing
- Breathing <8 breaths a minute
- Breathing >25 breaths a minute
- Oxygen saturation ≤90%, despite high-flow oxygen

IF PATIENT IS NOT BREATHING, CALL A CODE BLUE

CIRCULATION

- Pulse <40 beats a minute
- Pulse >120 beats a minute
- Low blood pressure (systolic <90 mm Hg)
- Urine output <50 ml over 4 hours

IF PATIENT HAS NO PULSE, CALL A CODE BLUE

CONSCIOUS STATE

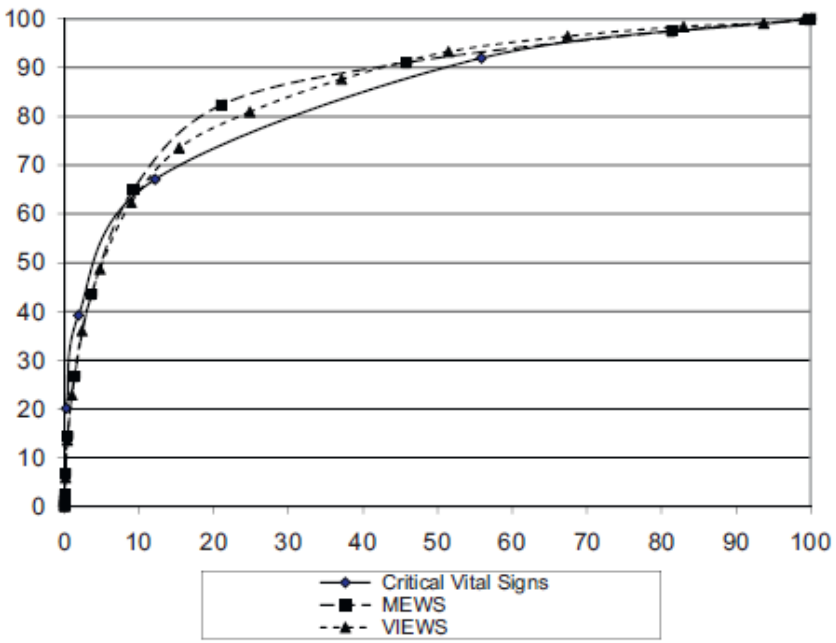
- Sudden change in conscious state
- Patient cannot be roused

Longitudinal analysis of one million vital signs in patients in an academic medical center☆

Resuscitation 2011;82:1387

18 μήνες, 42.430 εισαγωγές

SBP < 85mmHg
HR > 120 bpm
RR < 13 or > 23 bpm
T < 35 or > 38.9
SpO2 < 91%
LOC anything but alert

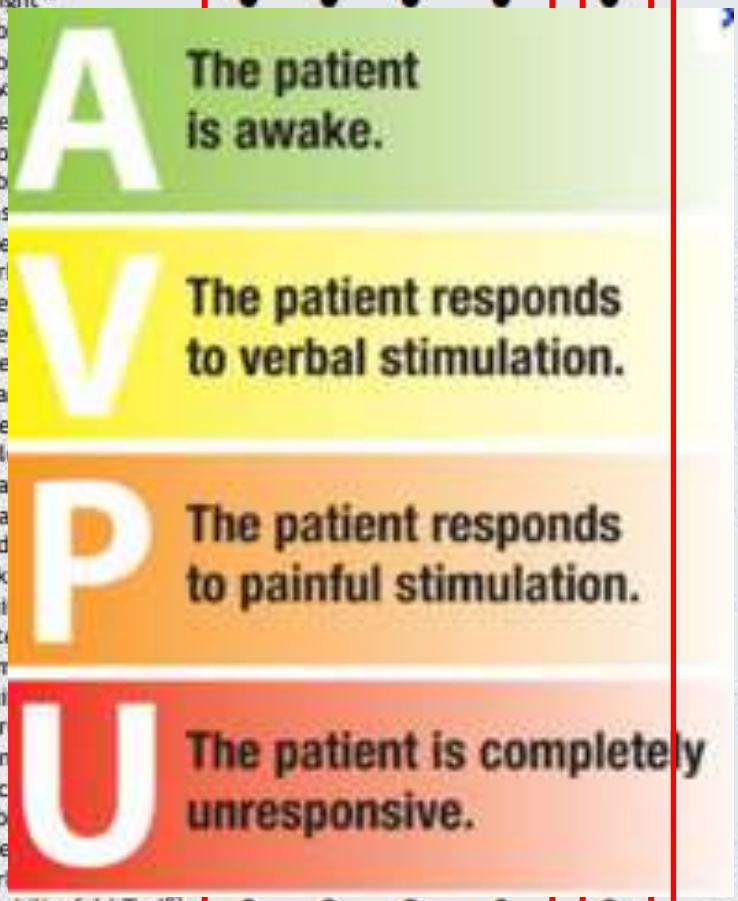


In-hospital mortality

Number of simultaneous critical vital signs	All ages
0	0.24 (44)
1	0.92 (174)
2	6.95 (295)
3	23.6 (186)
4 or more	42.4 (61)

ΣΥΣΤΗΜΑΤΑ ΣΤΑΘΜΙΣΜΕΝΗΣ ΒΑΡΥΤΗΤΑΣ

Year	System	Author and citation	PR	BR	sBP	AVPU	Temp	Urine	Age	S_pO_2	F_iO_2
1997	1	Morgan[25]	●	●	●	●	●				
2000	2	Wright[45]	●	●	●	●	●				
2001	3	Sub									
2001	4	Sub							●		
2001	5	Fox									
2001	6	Rile									
2001	7	Coo									
2002	8	Sub							●		
2002	9	Was									
2002	10	Ode									
2002	11	Car									
2003	12	Ree									
2004	13	Ree									
2004	14	Prie									
2004	15	Rya									
2004	16	Alle									
2005	17	Gol								●	?
2005	18	Cha									
2005	19	Hea									
2005	20	And									
2005	21	Bak							●	●	Air
2006	22	Smi									
2006	23	Pat								●	?
2006	24	Lam									
2006	25	Smi									
2006	26	Gar									
2006	27	Han									
2007	28	Duc								●	Air
2007	29	Sub							●		
2007	30	Ode									
2007	31	Bar								●	?
2007	32	Von Lilienfeld-Toal[82]	●	●	●	●	●				
2007	33	Von Lilienfeld-Toal[82]	●	●	●	●	●	●		●	?



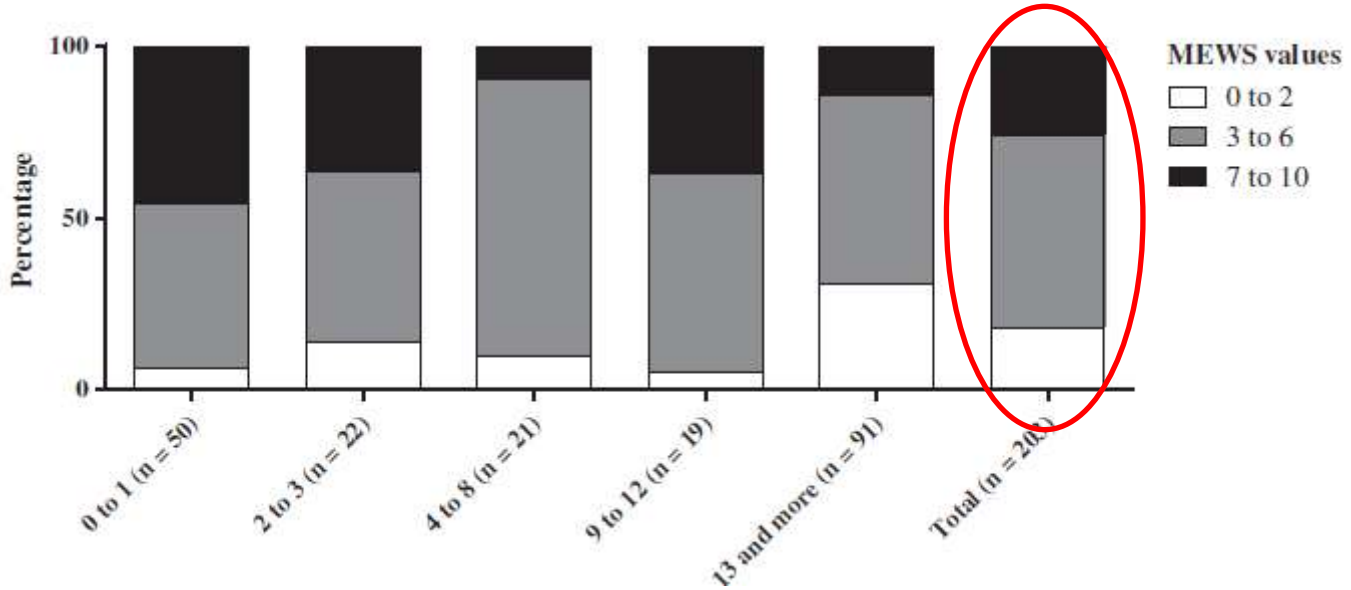
Resuscitation 2008;77:170

MEWS (Modified Early Warning System)

	3	2	1	0	1	2	3
Respiratory Rate per minute		Less than 8		9-14	15-20	21-29	More than 30
Heart Rate per minute		Less than 40	40-50	51-100	101-110	111-129	More than 129
Systolic Blood Pressure	Less than 70	71-80	81-100	101-199		More than 200	
Conscious level (AVPU)	**U**nresponsive	Responds to **P**ain	Responds to **V**oice	**A**lert	New agitation Confusion		
Temperature (°c)		Less than 35.0	35.1-36	36.1-38	38.1-38.5	More than 38.6	
Hourly Urine For 2 hours	Less than 10mls / hr	Less than 30mls / hr	Less than 45mls / hr				

Identification of deteriorating patients on general wards; measurement of vital parameters and potential effectiveness of the Modified Early Warning Score☆

JCC 2012;27:427.e7



81% των ασθενών που υπέστησαν σοβαρό ανεπιθύμητο σύμβαμα είχαν τουλάχιστον ένα MEWS ≥ 3 μέσα στις προηγούμενες 48 ώρες

NHS Early Warning Score (NEWS)

PHYSIOLOGICAL PARAMETERS	3	2	1	0	1	2	3
Pulse	≤40		41 - 50	51 - 90	91 - 110	111 - 130	≥131
Temperature	≤35.0		35.1 - 36.0	36.1 - 38.0	38.1 - 39.0	≥39.1	
Systolic BP	≤90	91 - 100	91 - 110	111 - 219			≥220
Respiration Rate	≤8		9 - 11	12 - 20		21 - 24	≥25
Consciousness Level				A			V, P, or U
Oxygen Saturations	≤91	92 - 93	94 - 95	≥96			
Any Supplemental Oxygen		Yes		No			

ADULT VITAL SIGNS ASSESSMENT

Royal United Hospital Bath NHS

Name: RW Date of Birth: __/__/__ NHS No: Ward:

A

B

C

D

Target Oxygen Saturation Range	
If O_2 is being given to achieve a target saturation range of 88-92%, Do NOT score oxygen saturation in NEWS	88-92% / 94-98% / Other (Please specify)
	Signature and date: 18/1

Pain score in use

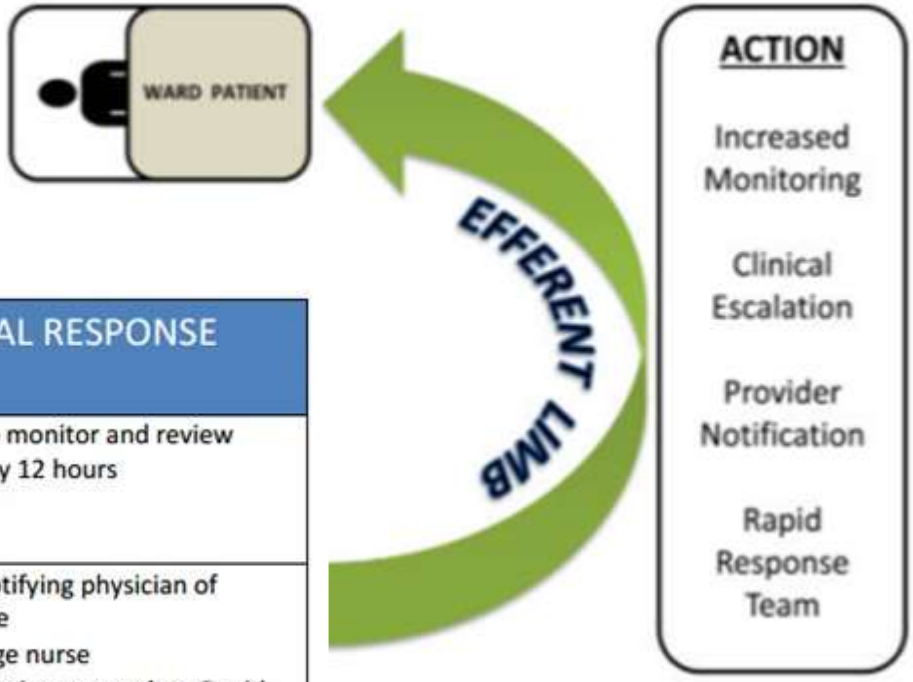
- Pain Numerical score (0-10) ☒
- Abbey Pain Assessment Scale (0-18) (for cognitively impaired) (Please tick) ☐
- Consider use of Pain Management Care Plan

Frequency of Assessment/Target Parameters (Must Complete at least once in 24 hours)

Date	Comments	Signature
18/	Blood culture	
20/	Simple Mask	

NEWS score	Clinical risk
0	Low
Aggregate 1 - 4	
RED score * Individual parameter score 3	Medium
Aggregate 5 - 6	
Aggregate 7 or more	High

Urine output of < 0.5 ml/kg for 2 consecutive hours - urgent medical review Hypotension is a medical emergency until proven otherwise



Score Range	FREQUENCY OF MONITORING	CLINICAL RESPONSE
0-4	Minimum 12 hours	• Continue to monitor and review MEWS every 12 hours
Total: 5-6	Minimum of 4 hours	• Consider notifying physician of MEWS score • Notify charge nurse • Consider placing a consult to Rapid Response Nurses • Increase MEWS assessment every 4 hours with increased frequency in assessments
Total: 7+	Minimum of 2 hours or per patient acuity	• Consider calling Physician with current assessment data • Consider calling a Rapid Response • Call RRT Consult nurse • Consider transfering to step-down or ICU

Rapid Response Team

Rapid Response Team

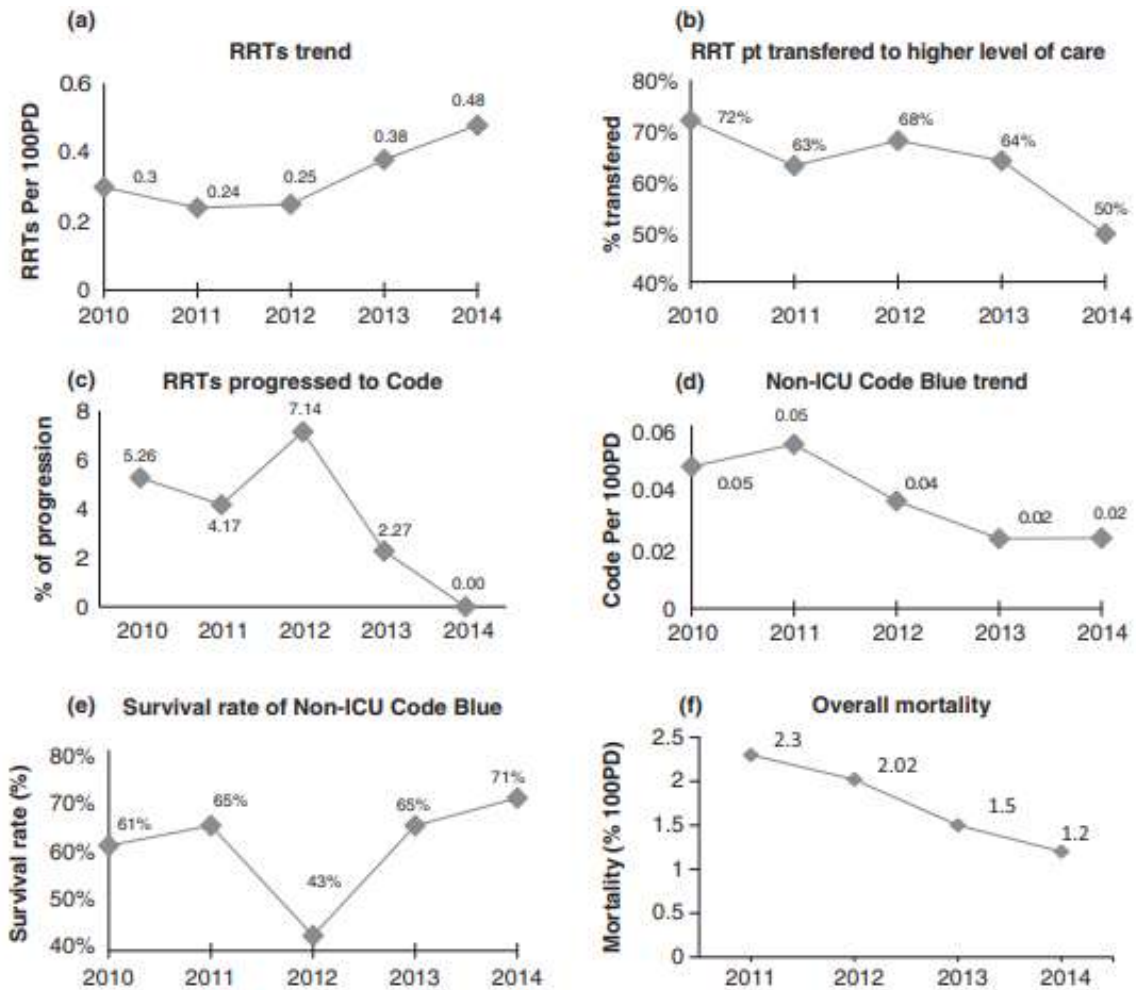
Table 1. Comparison between a Traditional Code Team and a Rapid-Response Team.*

Feature	Traditional Code Team	Rapid-Response Team
Typical criteria for calling the team	No recordable pulse, no recordable blood pressure, absence of respiratory effort, unresponsive	Low blood pressure, rapid heart rate, respiratory distress, altered consciousness
Typical conditions that the team assesses and treats	Cardiac arrest, respiratory arrest, airway obstruction	Sepsis, pulmonary edema, arrhythmias, respiratory failure
Typical team composition	Anesthesia fellow, ICU fellow, internal-medicine house staff, ICU nurse	ICU fellow, ICU nurse, respiratory therapist, internal-medicine house staff
Typical call rate (no./1000 admissions)	0.5–5	20–40
Typical in-hospital mortality (%)	70–90	0–20

NEJM 2011;365:139

Modified Early Warning System improves patient safety and clinical outcomes in an academic community hospital

JCHIMP 2015;5:26716



Effectiveness of Rapid Response Teams on Rates of In-Hospital Cardiopulmonary Arrest and Mortality: A Systematic Review and Meta-analysis

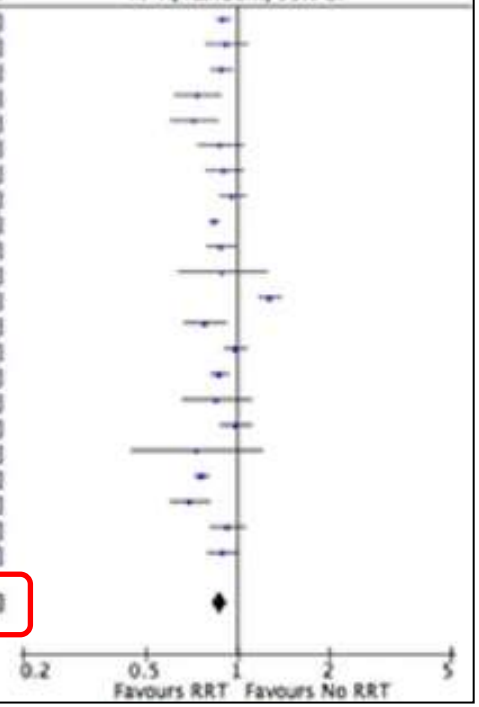
J Hosp Med 2016;11(6):438

In-hospital mortality

Study or Subgroup	RRT Events	RRT Total	No RRT Events	No RRT Total	Weight	Risk Ratio M-H, Random, 95% CI
Al-Qahtani 2013	3191	157804	2214	98391	5.9%	0.90 [0.85, 0.95]
Bader 2009	292	16907	300	15949	4.2%	0.92 [0.78, 1.08]
Beitler 2011	1086	79013	1194	77021	5.5%	0.89 [0.82, 0.96]
Bellomo 2003	222	20921	302	21090	3.9%	0.74 [0.62, 0.88]
Bristow 2000 (hospital 1 vs 2)	243	18338	240	13059	3.9%	0.72 [0.60, 0.86]
Bristow 2000 (hospital 1 vs 3)	243	18338	295	19545	4.0%	0.88 [0.74, 1.04]
Buist 2002	393	28801	380	25194	4.5%	0.90 [0.79, 1.04]
Chan 2008	773	24978	780	24193	5.3%	0.96 [0.87, 1.06]
Chen 2014	5157	404116	14324	942368	6.2%	0.84 [0.81, 0.87]
Concales 2012	614	42796	651	40033	5.1%	0.88 [0.79, 0.98]
Hillman 2005	72	68376	67	56756	1.9%	0.89 [0.64, 1.24]
Jones (Medical) 2007	3489	73807	664	17893	5.5%	1.27 [1.17, 1.38]
Jones (Surgical) 2007	581	26436	209	7441	4.2%	0.78 [0.67, 0.91]
Kenward 2004	1054	53500	1070	53500	5.5%	0.99 [0.91, 1.07]
Konrad 2010	1214	73825	3847	203892	5.8%	0.87 [0.82, 0.93]
Lighthall 2010	203	9077	78	2975	2.7%	0.85 [0.66, 1.10]
Lim 2011	583	34699	569	33360	5.0%	0.99 [0.88, 1.10]
Moroseos 2014	31	9357	32	7092	1.1%	0.73 [0.45, 1.20]
Salvatierra 2014	2423	235344	3183	235718	6.0%	0.76 [0.72, 0.80]
Santamaria 2010	551	74616	240	22698	4.3%	0.70 [0.60, 0.81]
Segon 2014	417	14333	439	14013	4.7%	0.93 [0.81, 1.06]
Shah 2011	971	45145	390	16244	4.9%	0.90 [0.80, 1.01]
Total (95% CI)		**1530527**		**1948425**	**100.0%**	**0.88 [0.83, 0.93]**
Total events	23803		31468			

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 151.78$, df = 21 ($P < 0.00001$); $I^2 = 86\%$

Test for overall effect: $Z = 4.45$ ($P < 0.00001$)



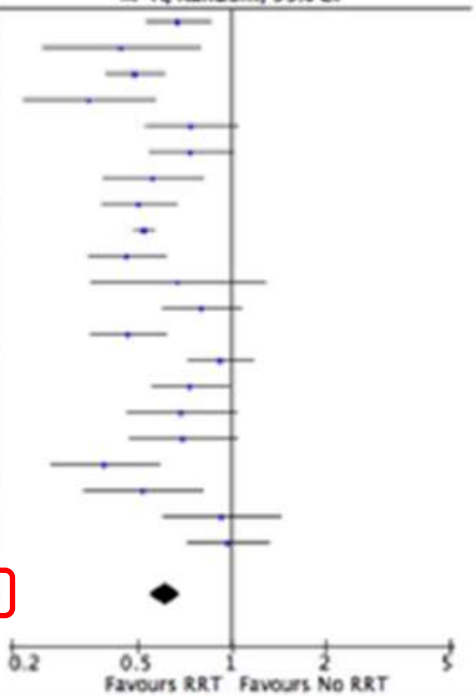
Effectiveness of Rapid Response Teams on Rates of In-Hospital Cardiopulmonary Arrest and Mortality: A Systematic Review and Meta-analysis

J Hosp Med 2016;11(6):438

In-hospital Cardiac arrest

Study or Subgroup	RRT Events	RRT Total	No RRT Events	No RRT Total	Weight	Risk Ratio M-H, Random, 95% CI
Al-Qahtani 2013	144	157804	133	98391	5.9%	0.68 [0.53, 0.85]
Bader 2009	17	16907	36	15949	2.7%	0.45 [0.25, 0.79]
Beitler 2011	128	79013	253	77021	6.2%	0.49 [0.40, 0.61]
Bellomo 2003	22	20921	63	21090	3.3%	0.35 [0.22, 0.57]
Bristow 2000 (hospital 1 vs 2)	69	18338	66	13059	4.7%	0.74 [0.53, 1.04]
Bristow 2000 (hospital 1 vs 3)	69	18338	99	19545	5.1%	0.74 [0.55, 1.01]
Buist 2002	47	28801	73	25194	4.4%	0.56 [0.39, 0.81]
Chan 2008	77	24978	147	24193	5.5%	0.51 [0.39, 0.67]
Chen 2014	845	404116	3741	942368	7.6%	0.53 [0.49, 0.57]
Goncales 2012	71	42796	143	40033	5.3%	0.46 [0.35, 0.62]
Hatler 2009	16	25470	23	24739	2.3%	0.68 [0.36, 1.28]
Hillman 2005	90	68376	93	56756	5.3%	0.80 [0.60, 1.07]
Jones 2005	198	104001	66	16246	5.4%	0.47 [0.35, 0.62]
Kenward 2004	128	53500	139	53500	5.9%	0.92 [0.72, 1.17]
Konrad 2010	61	73825	228	203892	5.4%	0.74 [0.56, 0.98]
Lighthall 2010	74	9077	35	2975	4.1%	0.69 [0.46, 1.03]
Lim 2011	43	34699	59	33360	4.1%	0.70 [0.47, 1.04]
Moroseos 2014	37	9357	71	7092	4.1%	0.39 [0.27, 0.59]
Santamaria 2010	125	81628	24	8190	3.7%	0.52 [0.34, 0.81]
Segon 2014	40	14333	42	14013	3.8%	0.93 [0.60, 1.43]
Shah 2011	157	45145	58	16244	5.1%	0.97 [0.72, 1.32]
Total (95% CI)		**1331423**		**1713850**	**100.0%**	**0.62 [0.55, 0.69]**
Total events	2458		5592			

Heterogeneity: Tau² = 0.04; Chi² = 69.04, df = 20 (P < 0.00001); I² = 71%
Test for overall effect: Z = 8.16 (P < 0.00001)



Respiratory rate: the neglected vital sign

MJA 2008;188:657

Ένα από τα πρωιμότερα και πιο ευαίσθητα σημεία επιδείνωσης
Καταγράφεται στο 15-23% των ασθενών (ΚΑΙ στα πνευμονολογικά τμήματα)

Διαταραχές του αναπνευστικού αλλά και άλλων συστημάτων

Ταχύπνοια (> 24/min)
- Μεταβολική οξέωση
- Σήψη
- Καρδιακή ανεπάρκεια
- Καταπληξία

Βραδύπνοια (< 12/min)
Καταστολή αναπνευστικού κέντρου
- Φάρμακα
- Υποθυρεοειδισμός
- ΑΕΕ
- ΚΕΚ

C	CONFUSION
U	UREMIA
R	RESPIRATORY RATE > 30
B	BLOOD PRESSURE
65	YEARS OF AGE OR

Box 1. SIRS (Systemic Inflammatory Response Syndrome)

Two or more of:

- Temperature >38°C or <36°C
- Heart rate >90/min
- Respiratory rate >20/min or $Paco_2$ <32 mm Hg (4.3 kPa)
- White blood cell count >12 000/mm³ or <4000/mm³ or >10% immature bands

Pneumonia Severity Index (PSI)

NEJM 1997; 336:243-50

Demographic factors Age (in years)

Men
Women -10
Nursing home resident +10

esses

lisease +30
e +20

se +10

hysical examination

tal status +20
n +20
nHg +20
°C or ≧ 40°C +15
HR ≧ 125 beats/min +10

Laboratory and CXR findings

Arterial pH <7.35 +30
BUN ≧ 30 +20
Sodium < 130 +20
Glucose ≧ 250 +10
Hematocrit <30% +10
PaO_2 < 60 mmHg or SpO_2< 90% +10
Pleural effusion +10

PSI Class	Total # Points	30-day mortality	Disposition
I	<51	0.1%	Outpatient
II	51-70	0.6%	Outpatient
III	71-90	0.9%	Outpatient vs short-stay inpatient
IV	91-130	9.3%	Inpatient
V	>130	27.0%	Inpatient ICU

Pulmonary Em

Predictors	Points
Age	+1 per year
Male sex	+10
Heart failure	+10
Chronic lung disease	+10
Arterial oxygen saturation <90%	+20
Pulse ≥110 beats per minute	+20
Respiratory rate ≥30 breaths per minute	+20
Temperature <36°C	+20
Cancer	+30
Systolic blood pressure <100 mm Hg	+30
Altered mental status	+60

GINA 2002, 2006, 2007

Severity of Asthma Exacerbations.....

	MILD	MODERATE	SEVERE	RESPIRATORY ARREST IMMINENT
Breathless Walking	Talking	At rest		
	Can lie flat	Infants - softer shorter cry Prefers sitting	Infants- Stops feeding *Hunched forward	
Talks in	Sentences	Phrases	Words	
lertness	May be agitated	Usually agitated	Usually agitated	
espiratory Rate	Increased	Increased	*Often >30/min	Bradypnea

Evaluation of the SpO_2/FiO_2 ratio as a predictor of intensive care unit transfers in respiratory ward patients for whom the rapid response system has been activated

PLoS ONE 2018;13(7):e0201632

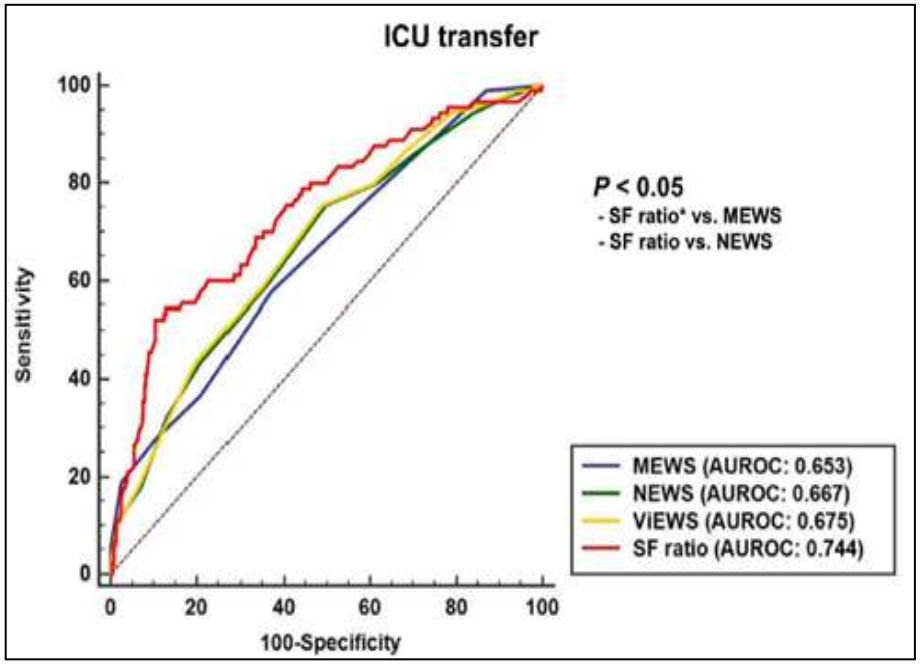


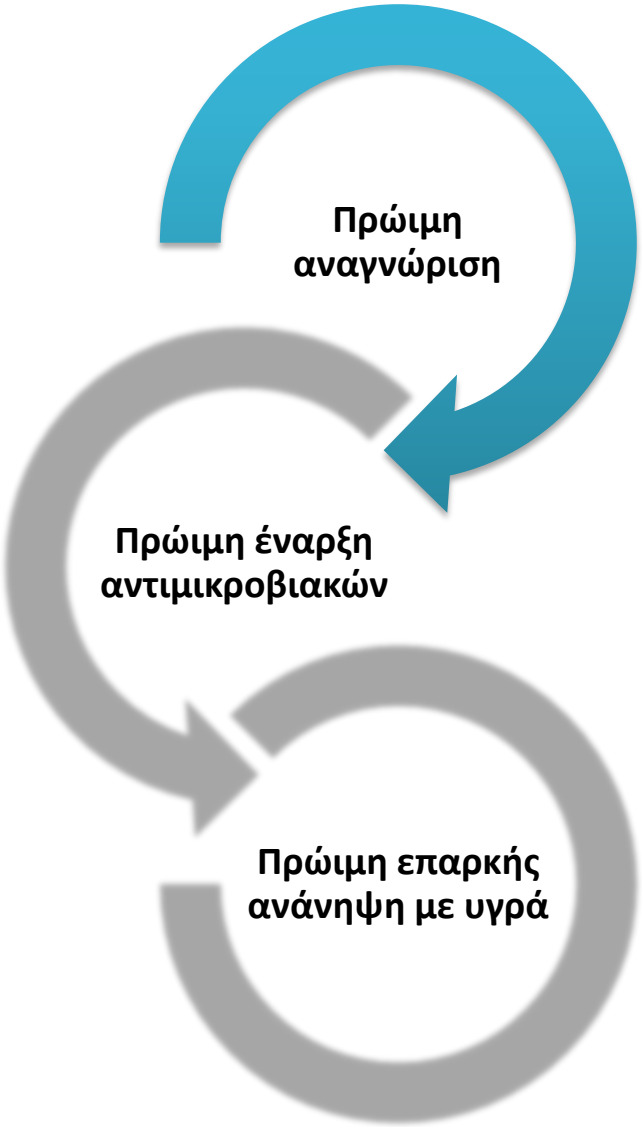
Table 4. Predictive values for intensive care unit transfers.

Variables	Sensitivity	Specificity
SF ratio* $\leq$ 170†	52.2 (41.4–62.9)	89.6 (86.0–82.5)
SF ratio $\leq$ 200	54.4 (43.6–65.0)	83.8 (79.1–87.0)
SF ratio $\leq$ 250	65.6 (54.8–75.3)	67.7 (62.7–72.5)
SF ratio $\leq$ 300	78.8 (69.0–86.8)	53.8 (48.6–59.0)

S/F ratio $\leq$ 170 → rule-in
S/F ratio > 300 → rule-out

Suspect SEPSIS

Save Lives



Surviving Sepsis Campaign BUNDLES

TO BE COMPLETED WITHIN 3 HOURS:

1) Measure lactate level.
2) Obtain blood cultures prior to administration of antibiotics.
3) Administer broad spectrum antibiotics.
4) Administer 30 ml/kg crystalloid for hypotension or lactate ≥4mmol/L.

Box 1. SIRS (Systemic Inflammatory Response Syndrome)

Two or more of:

- Temperature >38°C or <36°C
- Heart rate >90/min
- Respiratory rate >20/min or $Paco_2$ <32 mm Hg (4.3 kPa)
- White blood cell count >12 000/mm^3 or <4000/mm^3 or >10% immature bands

CCM 1992;20(6):864

Special Communication | CARING FOR THE CRITICALLY ILL PATIENT

The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)

JAMA. 2016;315(8):801-810. doi:10.1001/jama.2016.0287

qSOFA

ALTERED MENTAL STATUS

GCS < 15

FAST RESPIRATORY RATE

> 22/min

LOW BLOOD PRESSURE

SBP<100mmHg

- Εργαλείο αναγνώρισης ασθενών με λοίμωξη που έχουν δυσμενή πρόγνωση
- Αν **qSOFA ≥ 2**: έλεγχος για ενδεχόμενη λοίμωξη, έναρξη ή αναβάθμιση αγωγής, συχνότερη παρακολούθηση, μεταφορά στη ΜΕΘ

Performance of the quick Sequential (sepsis-related) Organ Failure Assessment score as a prognostic tool in infected patients outside the intensive care unit: a systematic review and meta-analysis

Crit Care 2018;22:28

23 μελέτες, 146.551 ασθενείς

In-hospital mortality

	sens	*spec*
qSOFA ≥ 2	51%	83%
SIRS ≥ 2	86%	29%

A Comparison of the Quick-SOFA and Systemic Inflammatory Response Syndrome Criteria for the Diagnosis of Sepsis and Prediction of Mortality

A Systematic Review and Meta-Analysis

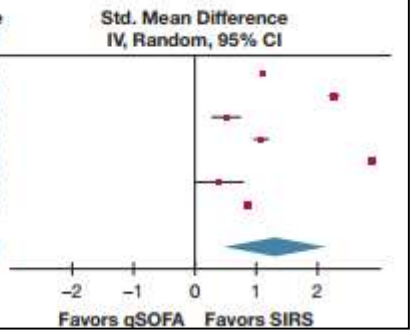
CHEST 2018

10 μελέτες (2 προοπτικές)
> 200.000 ασθενείς εκτός ΜΕΘ

Sepsis diagnosis

Study or Subgroup	SIRS Mean	SIRS SD	SIRS Total	qSOFA Mean	qSOFA SD	qSOFA Total	Weight	Std. Mean Difference IV, Random, 95% CI
Churpek, 2017	0.88	0.45	30,677	0.38	0.45	30,677	14.4%	1.11 (1.09 to 1.13)
Donnelly, 2017	0.54	0.02	2,593	0.12	0.26	2,593	14.3%	2.28 (2.21 to 2.35)
Dorsett, 2017	0.39	0.5	152	0.16	0.38	152	14.2%	0.52 (0.29 to 0.75)
Freund, 2017	0.74	0.45	879	0.25	0.45	879	14.3%	1.09 (0.99 to 1.19)
Raith, 2017	0.86	0.11	184,875	0.54	0.11	184,875	14.4%	2.91 (2.90 to 2.92)
Siddiqui, 2017	0.62	0.47	58	0.42	0.51	58	14.0%	0.41 (0.04 to 0.77)
Williams, 2017	0.47	0.48	8,871	0.1	0.34	8,871	14.4%	0.89 (0.86 to 0.92)
Total (95% CI)			**228,105**			**228,105**	**100.0%**	**1.32 (0.40 to 2.24)**

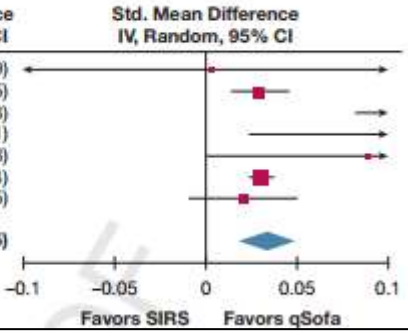
Heterogeneity: $Tau^2 = 1.53$; $Chi^2 = 43948.08$, df = 6 ($P < .00001$); $I^2 = 100\%$
Test for overall effect: Z = 2.81 ($P = .005$)



Sepsis mortality prediction

Study or Subgroup	qSOFA Mean	qSOFA SD	qSOFA Total	SIRS Mean	SIRS SD	SIRS Total	Weight	Std. Mean Difference IV, Random, 95% CI
April, 2017	0.66	2.61	214	0.65	2.61	214	0.7%	0.00 (−0.19 to 0.19)
Churpek, 2017	0.69	1.34	30,677	0.65	1.34	30,677	31.9%	0.03 (0.01 to 0.05)
Finkelsztein, 2017	0.74	0.47	152	0.59	0.5	152	0.5%	0.31 (0.08 to 0.53)
Freund, 2017	0.8	1.59	879	0.65	0.83	879	2.8%	0.12 (0.02 to 0.21)
Park, 2017	0.733	1.54	1,009	0.599	1.46	1,009	3.2%	0.09 (0.00 to 0.18)
Raith, 2017	0.607	0.88	184,875	0.58	0.88	184,875	42.6%	0.03 (0.02 to 0.04)
Williams, 2017	0.73	0.48	8,871	0.72	0.48	8,871	18.3%	0.02 (−0.01 to 0.05)
Total (95% CI)			**226,677**			**226,677**	**100.0%**	**0.03 (0.02 to 0.05)**

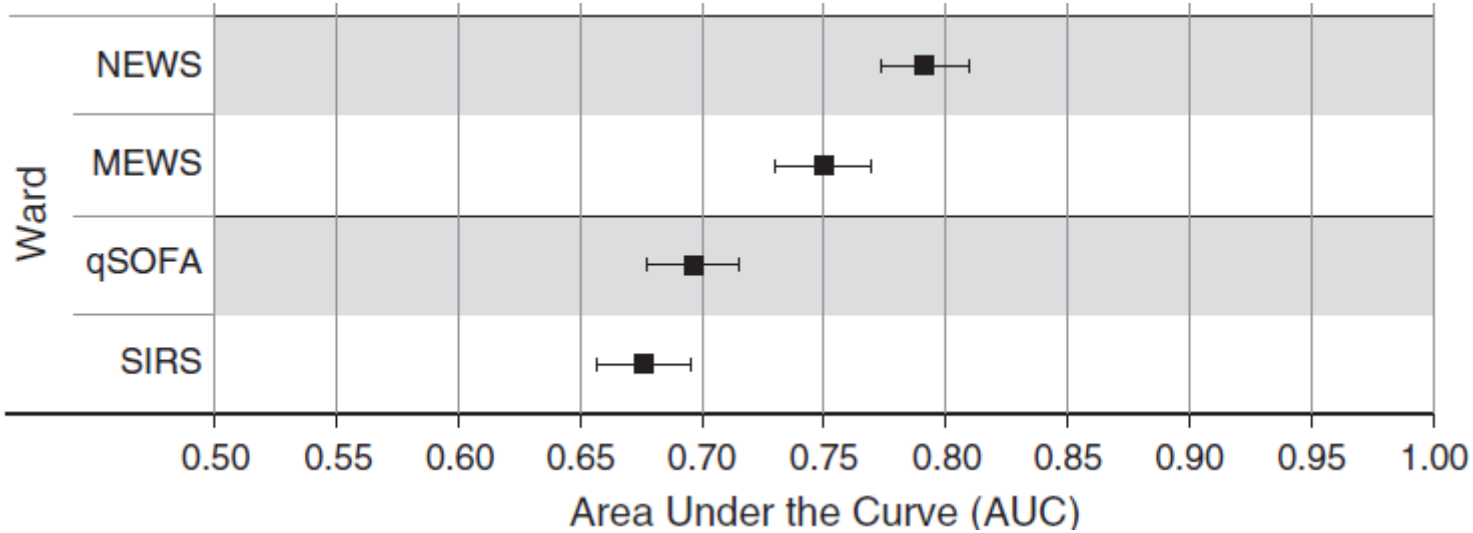
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 11.39$, df = 6 ($P = .08$); $I^2 = 47\%$
Test for overall effect: Z = 4.12 ($P < .0001$)



Quick Sepsis-related Organ Failure Assessment, Systemic Inflammatory Response Syndrome, and Early Warning Scores for Detecting Clinical Deterioration in Infected Patients outside the Intensive Care Unit

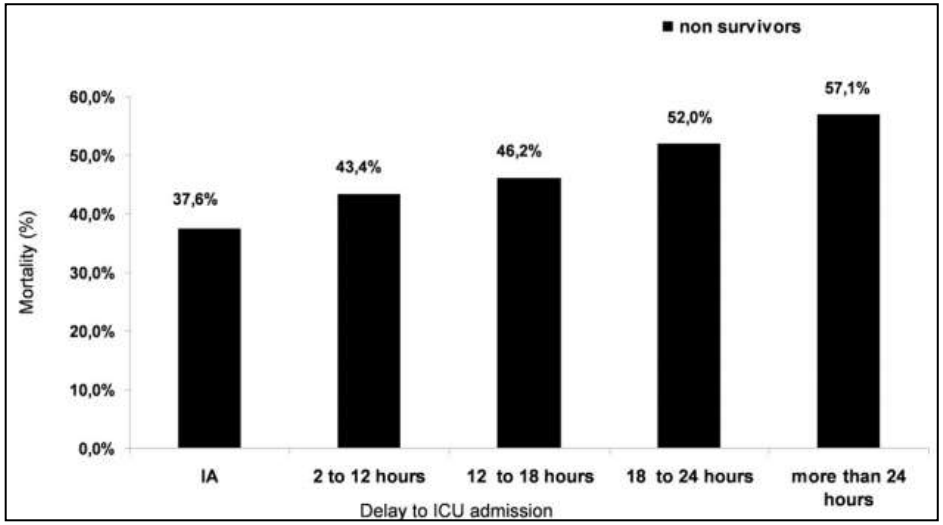
AJRCCM 2017;195(7):906

2008-2016
30.677 ασθενείς με υποψία λοίμωξης
24% θάνατος ή μεταφορά στη ΜΕΘ



Impact of delayed admission to intensive care units on mortality of critically ill patients: a cohort study

Crit Care 2011;15:R28



Τι μπορούμε να κάνουμε στην κλινική πράξη;

Τι μπορούμε να κάνουμε στην κλινική πράξη;

- Καταγραφή των ζωτικών σημείων τουλάχιστον μια φορά/24ωρο (καρδιακή συχνότητα, αναπνευστική συχνότητα, ΣΑΠ, θερμοκρασία)

- Εντοπισμός των ασθενών με διαταραχή των ζωτικών σημείων

- Ανασκόπηση του ιατρικού φακέλου, κλινική εξέταση (σημεία υποάρδευσης), κριτήρια SIRS, qSOFA

- ↑ συχνότητα παρακολούθησης

- Έγκαιρη επικοινωνία με τη ΜΕΘ

- Επίσπευση της μεταφοράς του ασθενούς στη ΜΕΘ


KEEP
CALM
THINK
PATIENT
SAFETY