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Identifying Patients At Risk and Patients in Need

Thomas Schmidt, <u>schmidt@mmmi.sdu.dk</u>

How can we help clinicians identify patients at risk and patients in need?



PLOS ONE

Prognosis and Risk Factors for Deterioration in Patients Admitted to a Medical Emergency Department

Daniel Pilsgaard Henriksen¹*, Mikkel Brabrand², Annmarie Touborg Lassen¹

1 Department of Emergency Medicine, Odense University Hospital, Odense, Denmark, 2 Department of Medicine, Sydvestjysk Sygehus, Esbjerg, Denmark

Abstract

Objective: Patients that initially appear stable on arrival to the hospital often have less intensive monitoring of their vital signs, possibly leading to excess mortality. The aim was to describe risk factors for deterioration in vital signs and the related prognosis among patients with normal vital signs at arrival to a medical emergency department (MED).

Hundreds of track & trigger systems

	Rød Ivstruende	Orange Haster	Gul Haster mindre	Grøn Haster ikke	Blå Fast Track
A Ikke	fri luftvej viratorisk stridor	Truet luftvej	Fri luftvej	Fri luftvej	Upåvirkede Fast Track patienter får som udgangs- punkt ikke målt vitale
B SpO SpO RF >)₂ < 80% uden O₂)₂ < 90% med O₂ ▶ 35 eller < 8	SpO2 < 90% uden O2 SpO2 < 95% med O2 RF > 30	SpO ₂ < 95% uden O ₂ RF > 25	SpO₂ ≥ 95% uden O₂ RF: 8 – 25	parametre. Ved ændring i patientens tilstand vurderes behovet
C Puls BTage	; > 140 ₅ < 80 mmHg	Puls > 120 eller Puls < 40 BT ₉₉₅ < 90 mmHg	Puls > 110 eller Puls < 50 BT _{sys} < 90 mmHg	Puls: 50 – 110 BT _{sys} ≥ 90 mmHg	for måling af vitale parame- tre og fortsat observation.
D	≤8	GCS: 9 – 13	GCS = 14	GCS = 15	
E ^{Tp <}	∶32°C	Tp < 40° C Tp: 32 – 34° C	Tp < 38° C Tp < 35° C	Tp: 35 – 38° C	
	F	or patienter med kendt KOL neds	sættes saturations-grænsen med	5%	
B SpO	0₂ < 75% uden O₂ 0₂ < 85% med O₂	$SpO_2 < 85\%$ uden O_2 $SpO_2 < 90\%$ med O_2	$SpO_2 < 90\%$ uden O_2	$SpO_2 \ge 90\%$ uden O_2	
RF = Respiratio	onsfrekvens, GCS = Glasgo	ow Coma Scale, SpO ₂ = Perifer k	kapillær iltmætning.		
Observationsregime	Rødt	Orange	Gult	Grønt	Blåt
Observation af vitale værdier	Kontinuerlig observation	Kontinuerlig observation	Hver 2. time i 24 timer, herefter hver 4. time	Hver 4. time i 24 timer, herefter hver 8. time	Efter ordination
	Tempmåling hver 4. time	Tempmåling hver 4. time	Tempmåling kl.06 og kl.22	Tempmåling kl. 06 og kl. 22	Efter ordination
Tidspunkt	Kl. 06, kl. 07, kl. 08,		KI. 06, kl. 08, kl. 10,	KI. 06, kl. 10, kl. 14,	Efter ordination
Dokumentation i COSMI	IC Minimum hver tim	e Minimum hver time	Ved hver observation	Ved hver observation	Ved hver observation

Observationsregimerne udstikker retningslinjer for hyppighed af observation og tidspunkt samt krav til dokumentation.







Dealing with the challenge







Monitoring on a fairly average day

VEST		ØST		A zo	ne		ORANGE		NORD	
VEST 1	2	ØST 1	12	ØST	9	0	VEST 9	86	NORD 9	5
VEST 2	277	ØST 2	1092	ØST	10	0	VEST 10	484	NORD 10	47
VEST 3	6	ØST 3	85	ØST	11	1	VEST 11	7	NORD 11	99
VEST 4	20	ØST 4	193	ØST	12	0	VEST 12	403	NORD 12	102
VEST 5	7	ØST 5	1	ØST	13	73	VEST 13	1138	NORD 13	12
VEST 6	298	ØST 6	5	ØST	14	0	VEST 14	634	NORD 14	92
VEST 7	19	ØST 7	1439	ØST	15	2				
VEST 8	549	ØST 8	6	ØST	16	2				
NORD 1	4	NORD 15	0	ØST	17	0				
NORD 2	0	NORD 16	23	ØST	18	4				







Data acquisition



Systolic blood pressure Diastolic blood pressure

8.248.838 vital values registered.9.780 patients admittedAnonymized & linked when possible

Vital sign	Measurements	Mean	Std Dev.
Heart rate	4,668,890	88 bpm	21 bpm
Respiration rate	4,491,545	20.4 rpm	5.7 rpm
Pulse rate	7,277,427	84.4 bpm	19.3 bpm
Oxygen saturation	7,181,287	95%	3.8%
Systolic blood pressure	232,895	124 mmHg	26.4 mmHg
Diastolic blood pressure	232,895	68.4 mmHg	17.9 mmHg

Table 6: Summary of registered vital signs.













Two examples of use







Seeking group normality



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Factors influencing degree of monitoring

Monitor load = # VS_registrations Length of Stay

Quartile Regression Analysis of:

- Patient specific factors
 - Sex
 - Age
 - Charlson Comorbidity
 - Initial Triage
- Department factors
 - Distance from nursing office
 - Concurrent load
 - Wing



Quantile	0.10	0.20	0.30	0.4	0.5	0.6	0.7	0.8	0.9
Monitor load	0.0015	0.0023	0.0033	0.0053	0.0135	0.1085	0.2795	0.5015	0.7532









Patient monitoring

EMERGENCY MEDICINE PRACTICE

EBMEDICINE.NET

AN EVIDENCE-BASED APPROACH TO EMERGENCY MEDICINE

Critical Care Monitoring In The Emergency Department

"Good monitoring grants control of chaotic situations"

July 2007 Volume 9, Number 7

Authors

Chad M. Meyers, MD

Critical Care Fellow, Department of Anesthesiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA

Scott D. Weingart, MD

Director, Division of Emergency Critical Care, Department of Emergency Medicine, Mount Sinai School of Medicine, New York, NY

What is 'good monitoring' then?







Situational Awareness



sectoral 2	Der er ikke tilskattet nogen alarmaksiver		22-04-2015 12:10 PHIL
ST 17	EJ DATA FRA SENG	VEST 7	MONITOR STANDBY
		Patientplacering:	
IST 18	EJ DATA PRA SENG	VEST 8	MONITOR STANDBY
		Patientplacering:	
EST 1	MONITOR STANDBY	VEST 9	MONITOR STANDBY
Patientplacering:		Patientplacering:	
EST 2	MONITOR STANDBY	VESTIC	5p02 SENSOR FRA
Patientplacering:		2 - t - t	HF BE Sp02
EST 3	MONITOR STANDBY	VESTII	
Patientplacering:		+1	HF 73 8002
EST 4	MONITOR STANDBY	VEST12	MONITOR STANDBY
Patientplacering:		Petentplacering	
EST 5	MONITOR STANDBY	VEST13	RESP LØS ELEKTR. +
Petertplacering		-	2HP 7 5p02
EST 6	MONITOR STANDBY	VEST14	MONITOR STANDBY
Patientplacering:		Patientplacering	
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PLETH	-llll	~L~ [#] 88 *** ? ***	Kontinuerig udskrift
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Development of a new solution

We conduct research to change the world!

But what if we're from different worlds?



"I can easily hack together this cool dohickey that you might find useful"

"Might, who, when, what?" ...and what about my golden standards?



MEN ARE FROM MARS, Women, Are From Venus

A Practical Guide for Improving Communication and Getting What You Want in Your Relationships

JOHN GRAY, Ph.D.

Growth Forum

Innovation Fund Denmark









Prototype & Pilot study



Evaluated together with 18 nurses; reviewing a total of 50 patients.





So now what?



• How do we check it?

Three angles



The clinical angle

Do we reduce the number of unexpected deteriorations by 50%?

The technical angle

Did we build a system that helps clinicans do their job better?





The economical angle

Does it save us money?







Effect evaluation study







Interaction via touch screen enabled ChromeOS devices







The endgame

- Moving from:
 "The Patient Date
 - "The Patient Deterioration Warning System"
- To:
 - "The Patient Deterioration Detection System"
- Service delivery options
 - As a Stand alone system
 - As a Plug-in component for existing health information systems
 - As a REST web service







Thank you

- Uffe Kock Wiil, MMMI@SDU
- Annmarie Touborg Lassen, SDU+OUH
- Mikkel Brabrand, SDU+OUH
- Camilla Nørgaard Bech, OUH
- Michael Hansen-Nord, OUH
- Charlotte Mose, OUH
- And to the SDU Strategic Initiatives Fund!





