

Alerts and reminders: Is this all there is to clinical decision support?

Anne Miller, PhD



SCHOOL OF MEDICINE
VANDERBILT UNIVERSITY



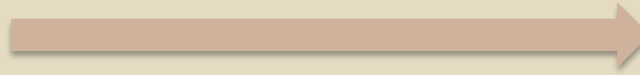
**CENTER
FOR RESEARCH
AND INNOVATION
IN SYSTEMS
SAFETY**

Overview

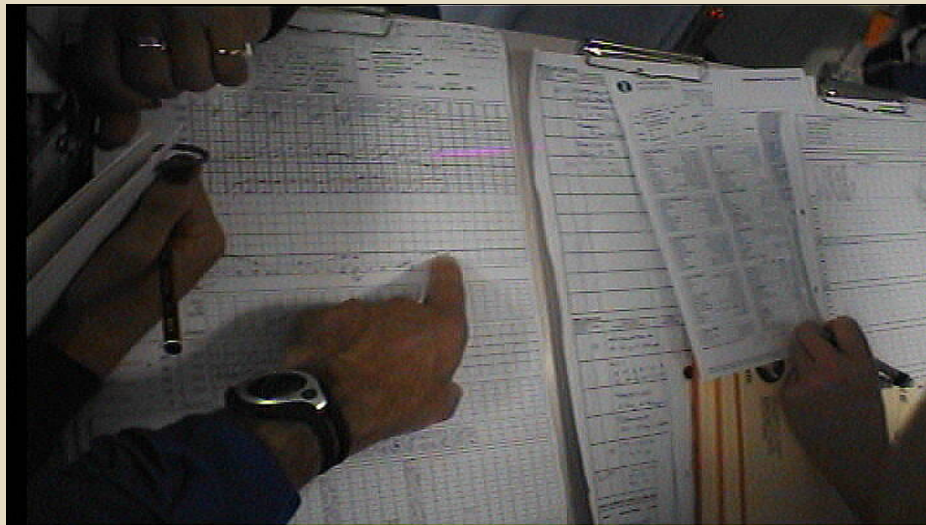
- Reminders and alerts
- Clinical decision making
- Iteration 1: information spaces
- Iteration 2: onscreen spaces
- Iteration 3: joint cognitive space

Clinical decision making

Diagnosis



Prescription

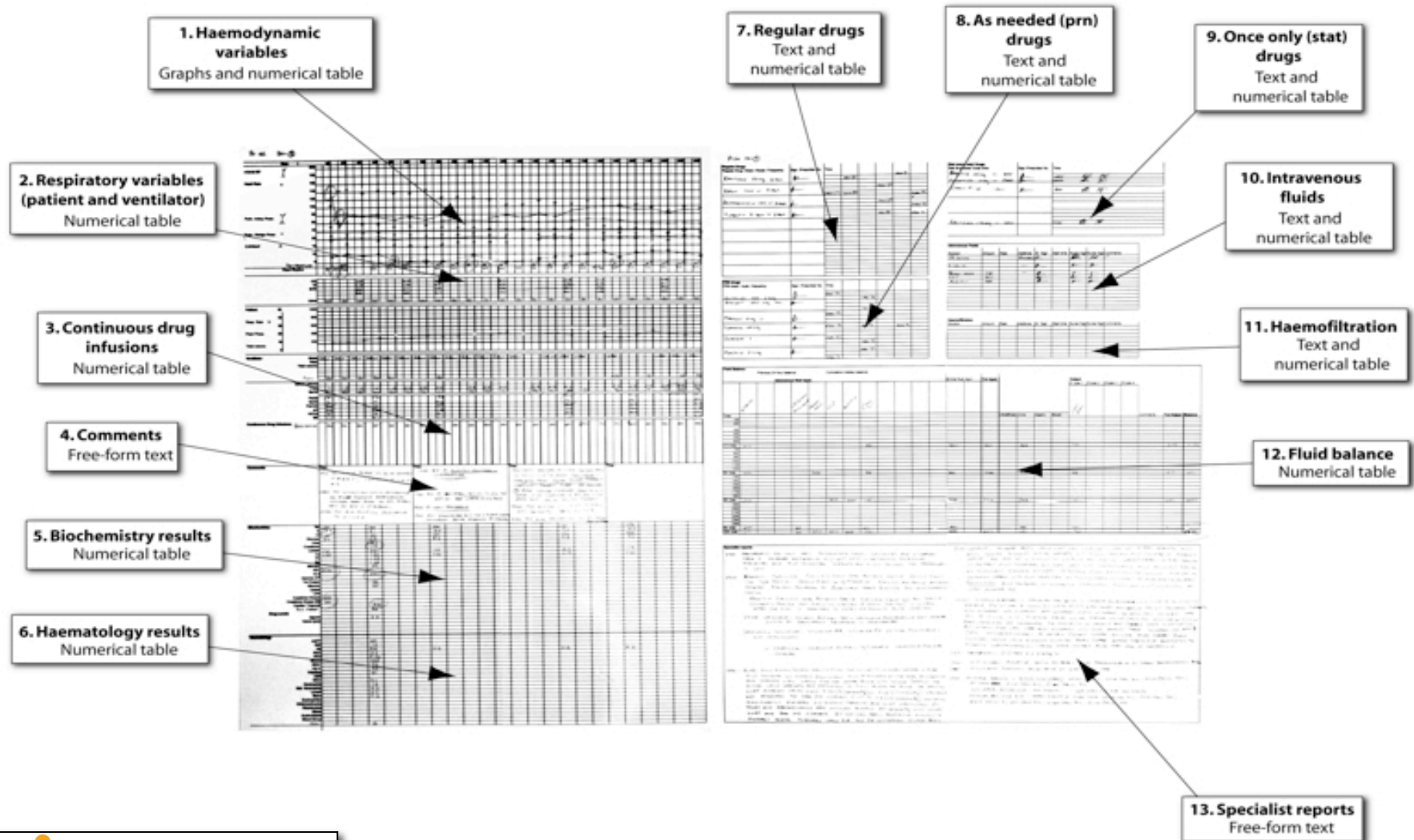


Monitoring



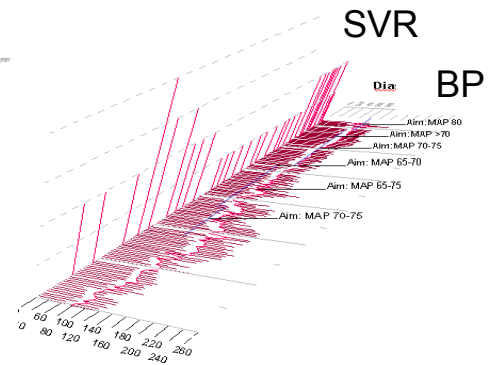
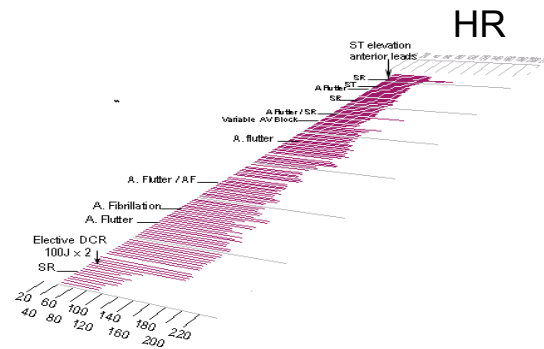
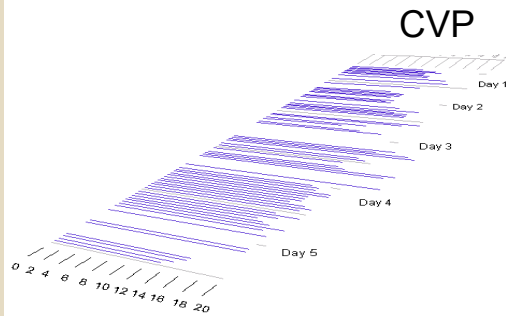
Administration

Traditional ICU chart designs

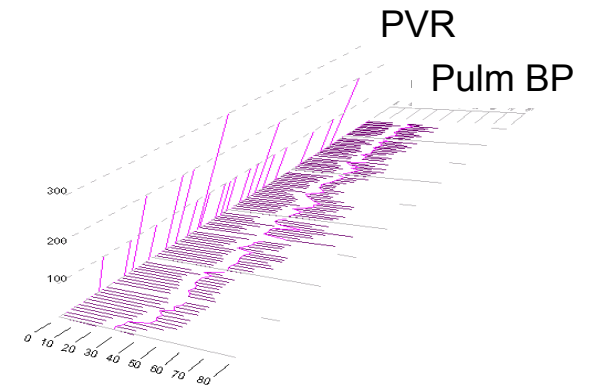
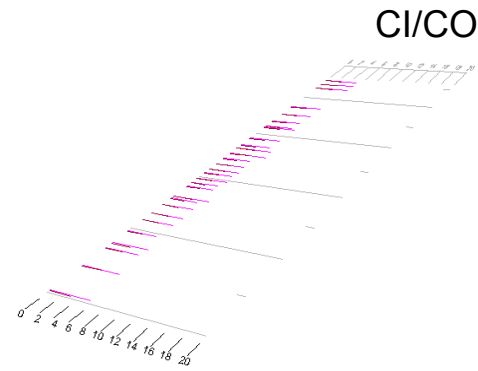
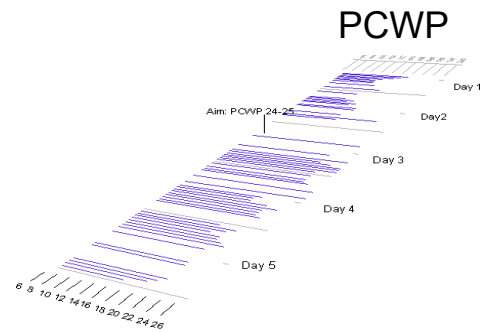


Iteration 1: Information environment

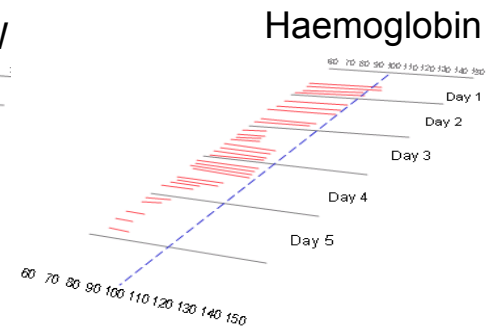
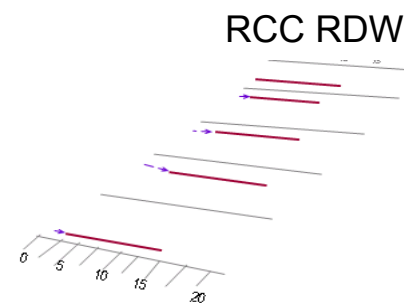
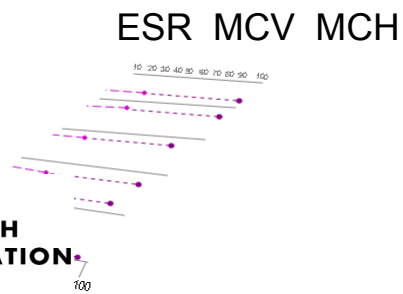
Systemic



Organ



Tissue



**CENTER
FOR RESEARCH
AND INNOVATION
IN SYSTEMS
SAFETY**

Evaluation results

ICU Resident physicians:

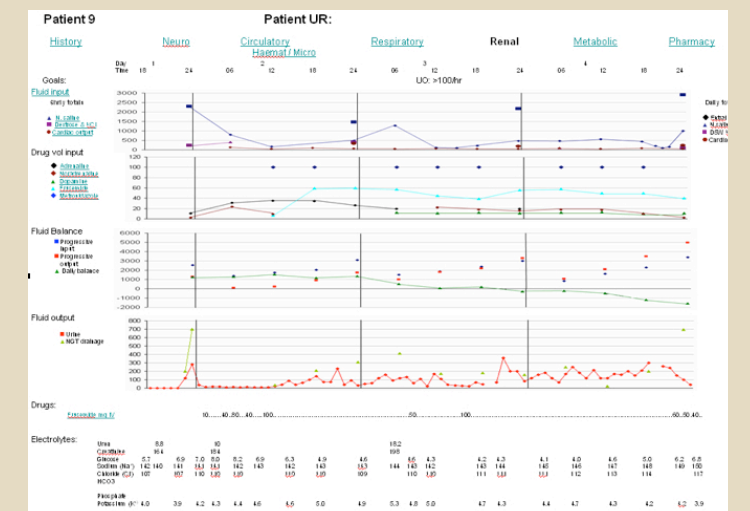
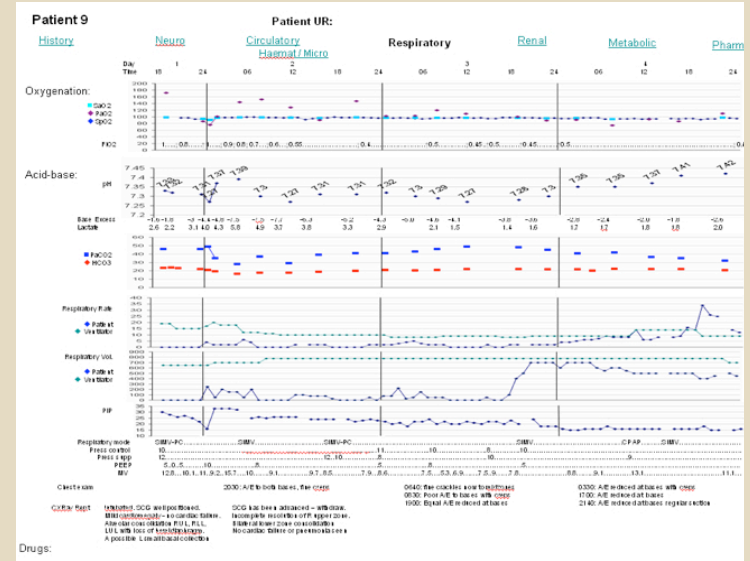
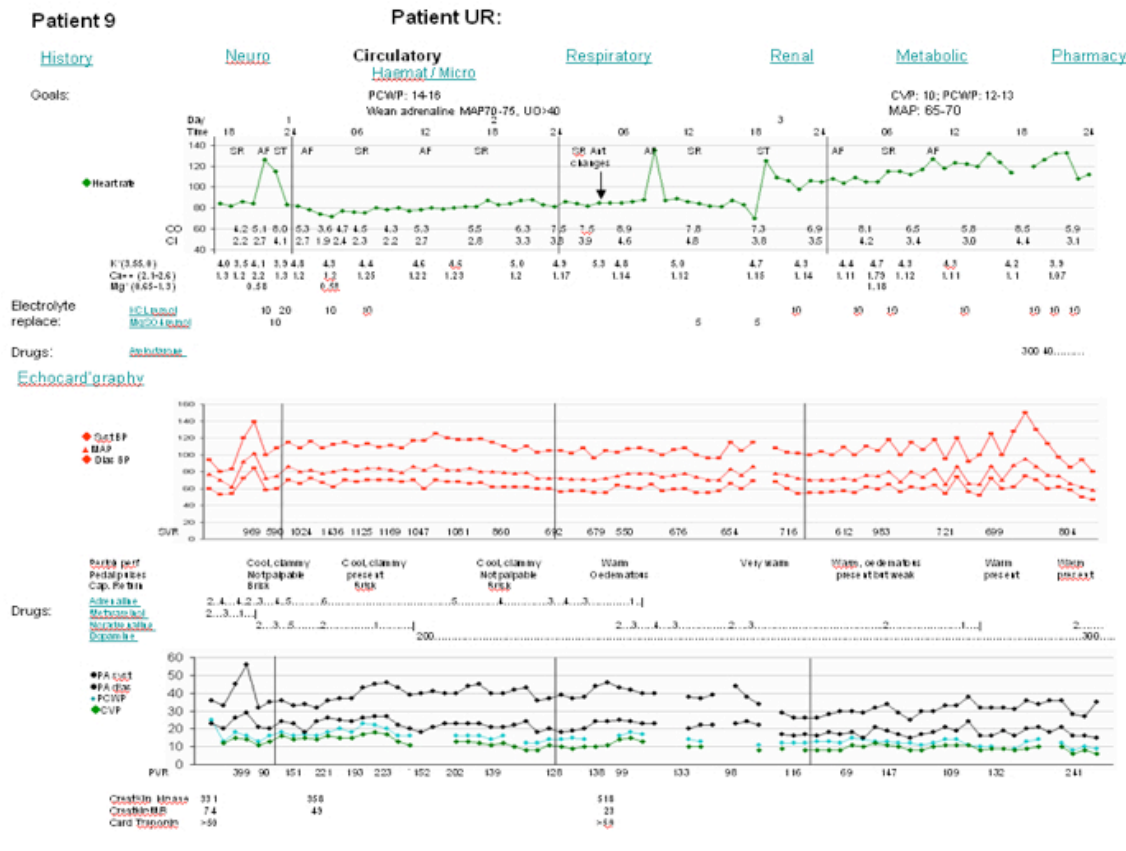
- better able to agree about current state diagnosis
(2 tailed t-test: $t=0.67$; $p>0.05$), but
- NS difference in ability to detect failed physiological systems

ICU Nurses:

- better able to detect changed parameters
(2-tailed t-test for d' : $t=2.39$; $p = 0.02$; for β : $t=2.86$, $p=0.01$)

Iteration 2: Onscreen spaces

Computerized mockup



Evaluation results

ICU Resident physicians:

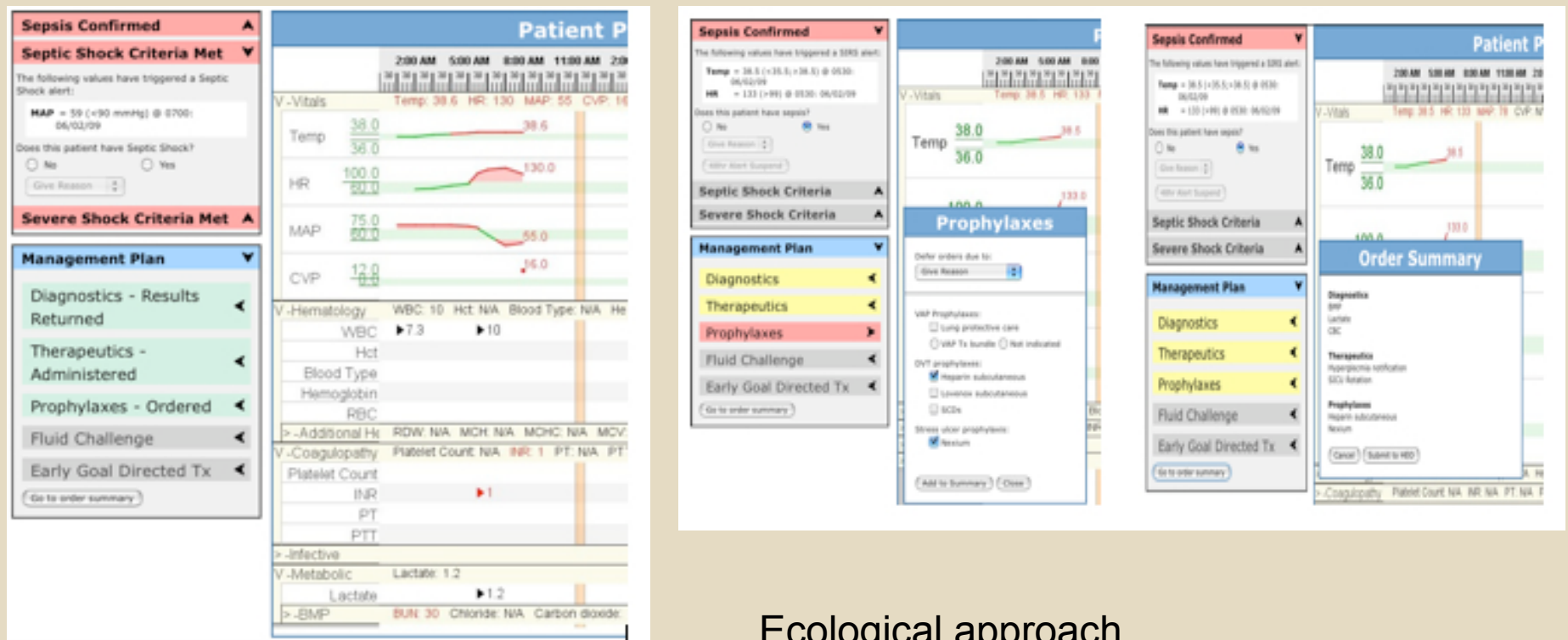
- Better able to agree about failed organs using Comp vs Charts ($t_6=3.14$, $p<0.01$). NS agreement about current state diagnosis.
- Agree about current state using Graphic vs Comp ($t_{10}=3.14$, $p<0.01$). Agree about failed systems better using Comp vs Graphic ($t_{10}=2.23$; $p<0.02$)

ICU Nurses:

- Better able to detect change using Comp vs Charts ($t_6 =3.14$ $p<0.01$ for d' ; t_6) 1.94, $p<0.05$ for β)
- Comp vs Graphic $t_6=5.96$. $p<0.001$ for d' ; NS for β

Iteration 3: joint cognitive space

24-hour Sepsis bundle



Ecological approach

Joint cognitive space

Computational approach

SIRS criteria

The following value(s) indicate criteria:

- HR over 90.0 - 99.0@2010-03-21 19:30:00.0
- MAP under 60.0 - 59.0@2010-03-22 05:00:00.0
- Temp outside range [36.0, 38.0] - 38.6@2010-03-22 01:24:00.0
- WBC outside range [4.0, 20.0] - 22.0@2010-03-22 02:00:00.0

Does this patient have sepsis?

Yes No Give reason

48hr alert suspend

Septic Shock Rx

Early Goal Directed Therapy

The following is the criteria:
(Lactate ≥ 4 OR MAP ≤ 60)

Confirm computer diagnosis?

No Yes

Select reason * Hide treatment

Early Goal Directed Therapy actions

Central Line Notification

In order to follow the Early Goal-Directed Therapy the patient needs a Central Line.

Optimize MAP

The following is the criteria:
MAP ≤ 60

Confirm computer diagnosis?

No Yes

Select reason * Hide treatment

Optimize MAP order

Evglight

Add to order summary

Optimize CIP

The following is the criteria:
CIP ≥ 8 OR CIP ≥ 12

Confirm computer diagnosis?

No Yes

Select reason * Hide treatment

Optimize CIP order

select one

Add to order summary

Low SIRS Rx

Prophylaxis

Confirm computer diagnosis?

No Yes

Select reason * Hide treatment

Prophylaxis actions

Long prophylactic care

- Ventilator Tx as per unit protocol
- MAP Prevention order
- VAP Tx Bundle
- DVT Prophylaxis order

- Propam, subcutaneous
- Jvenox, subcutaneous
- ICDs

Add to order summary

- No significant differences on task times
- Sign diff, tasks completed ($\chi^2 = 6.426$; $p < 0.04$)

Conclusions

Alerts & reminders: is that all there is to Clinical Decision Support? No, but:

- Need a more sophisticated understanding clinical decision making
- Professional decision niches
- Dealing with complexity (information, constraints, computation)

Collaborators

- Janos Mathe, PhD
- Andras Nadas, MS
 - Institute for Software Integrated Systems
- Michael Hooper, MD
- Lisa Weavind, MD
 - Department of Anesthesiology

Funding:

- Australian and New Zealand College of Anaesthetists (ANZCA)
- NIH Challenge Grant#: 1RC1LM010310-01