

Ecological Interface Design in e-Health systems

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CIHR IRSC

What is EID?

- Ecological Interface Design draws on psychological and engineering principles
- Provides information in a manner that is easy to understand, thus transparent to the operator

Effective Interface Design

- Shape performance
- Impact productivity
- Impact safety

Challenges:

- What information is required?
- Ease of deciphering display.

How can EID benefit e-Health?

- Provide interfaces that enable fast, effective use of technology
- Allow continuous feedback of patient information
- Enable remote monitoring to reduce the stress on healthcare system

Problems with present ID

“To err is human” (Institute of Medicine, 2000)

- Poor device design ↑ confusion ↑ error
 - Incorrect dosage
 - Patient – prescription mismatch
 - Inadequate data management

(Lambert 1999, Abookire 2000, Koppel 2005)

EID applications to medicine

- **Neonatal Intensive Care Units** (Sharp and Helmicki, 1998)
- **Patient monitoring in Operating Room** (Hajdukiewicz, 2001)
- **Narcoleptic Monitoring** (Kwok, 2004)
- **Diabetic Monitoring** (Burns and Hajdukiewicz, 2004)

Neonatal Intensive Care Unit

Time: 12:25:00, Screen 7 of 7

Pulse Oximetry

SpO₂:1225 66.0
HR:1255 80.0

Transcutaneous

TcPO₂:1225 30.0
TcCO₂:1225 39.0

Vital Sign Monitor

HR: 0.0
BP: 80.0
SYSTOL: 55.0
MEAN: 44.0
DIA: 34.0

Temperatures

Incubator:1225 33.0

Physical Findings

Core Temperature:
Heart Sounds: Diminished
Skin Perfusion: Poor
Peripheral Pulse: Decreased
Cap Refill Time: 4-5
Nail Color: Blue
Lips/Mucus Color: Blue
Arousal Level: Irritable
Tone: Decreased
Apnea:
Breath Sounds: Deminished
Grunting: Severe
Retractions: Mild

Inspired O₂

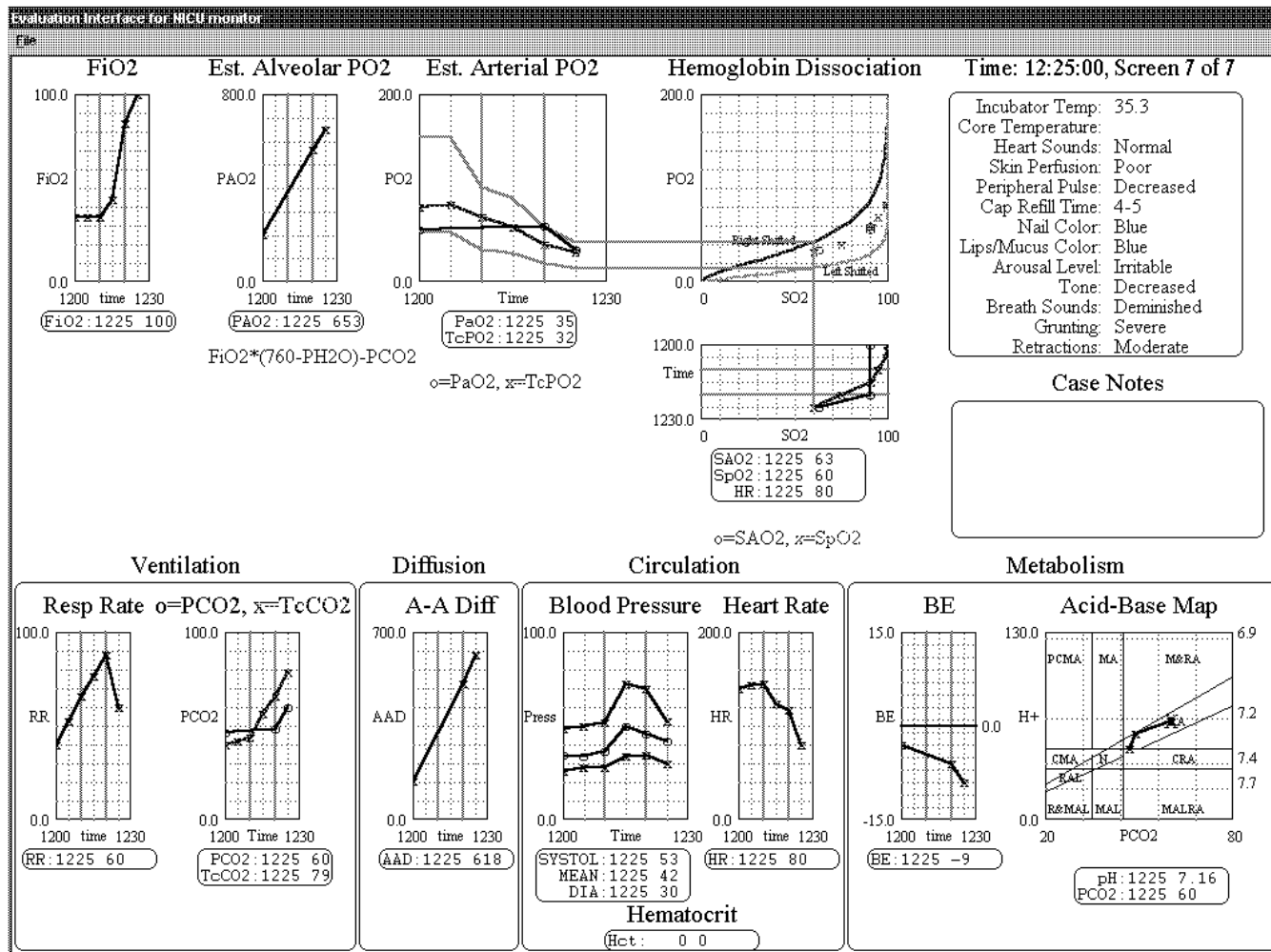
FI_{O2}:1225 100.0

Blood Gas Results

Date	Time	pH	PCO ₂	PaO ₂	PAO ₂	BE	Hct
0912	1200	7.300	47	57	90	-3	
0912	1215	7.370	40	83	99	-2	55*
0912	1220	7.200	52	62	88	-8	
0912	1225	7.050	68	32	60	-12	


Case Notes

Neonatal Intensive Care Unit





(Sharp and Helmicki, 1998)

Monitoring of Narcoleptics



Narcolepsy Treatment Assessment

File Edit View Help

Overview

Daytime Nighttime

Show: Last 6 months

	JAN							FEB							MAR							APR							MAY							JUN						
MON	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31	7	14	21	28			
TUE	6	13	20	27	4	11	18	25	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31			
WED	7	14	21	28	4	11	18	25	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31			
THU	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31			
FRI	9	16	23	30	6	13	20	27	4	11	18	25	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26				
SAT	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26				
SUN	11	18	25	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	3	10	17	24	31	7	14	21	28				

Overall Level of Alertness: Full (100%) Satisfactory ($\geq 80\%$) Poor ($\geq 20\%$) Very Poor ($< 20\%$)

Patient Information

Health Card #: 0000 000 000

Last Name: Shen

First Name: Jessie

Date of Birth: 29 Oct 1980 Age: 23

Height: 165 cm

Weight: 60 kg

[Details...](#)

Last Updated: Jun. 30, 2004 [Download...](#)

Prescription: Progil (Modafinil) - 100mg:

- Start with 3 tabs daily (one morning, one after lunch, one evening)
- Increase to 4 tabs daily

Epworth: 1 7 9 11 15

[Details...](#)

Night Monitoring of Narcoleptics



Narcolepsy Treatment Assessment



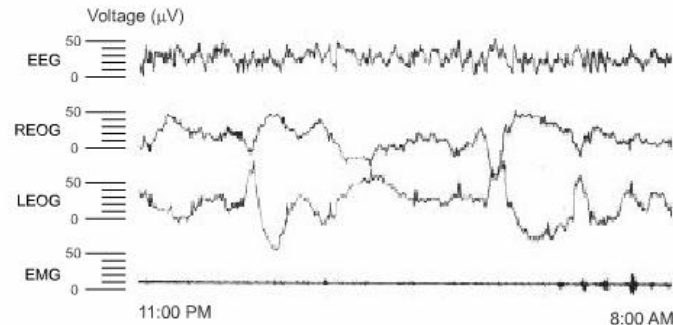
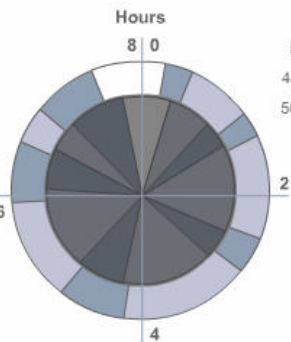
File Edit View Help

Overview

Daytime

Nighttime

Show: 30 Jul 2004



Patient Information

Health Card #: 0000 000 000

Last Name: Shen

First Name: Jessie

Date of Birth: 29 Oct 1980 Age: 23

Height: 165 cm

Weight: 60 kg

Details...

Last Updated: Jun. 30, 2004

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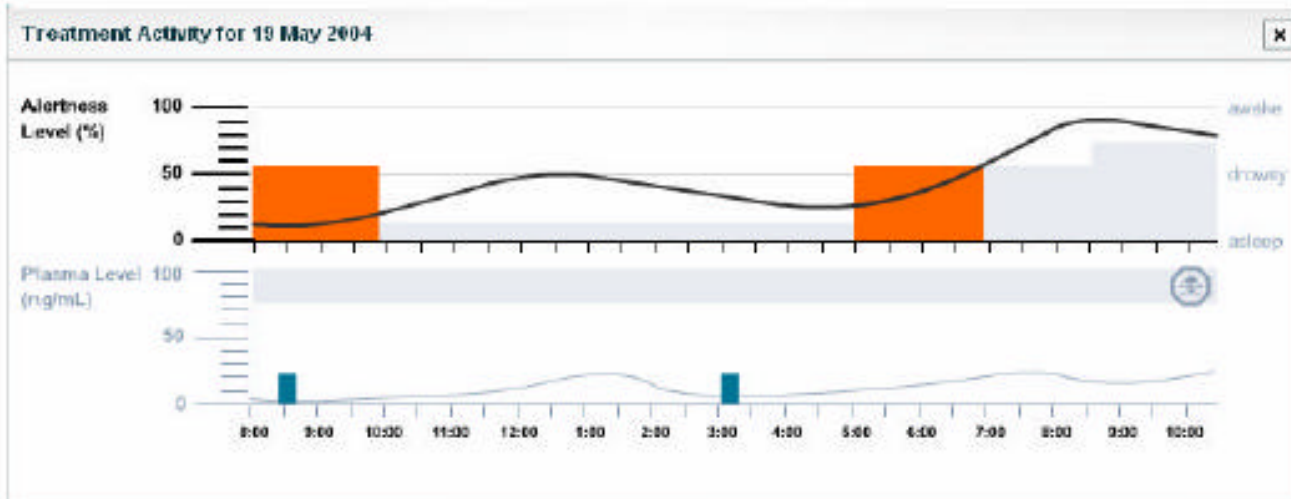
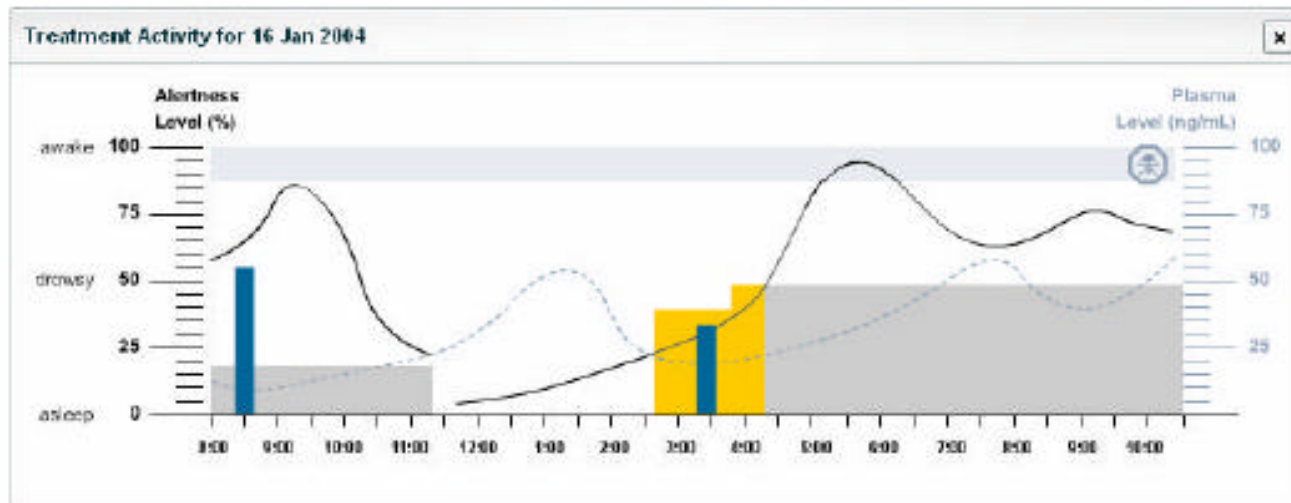
Epworth:



Details...

(Kwok, 2004)

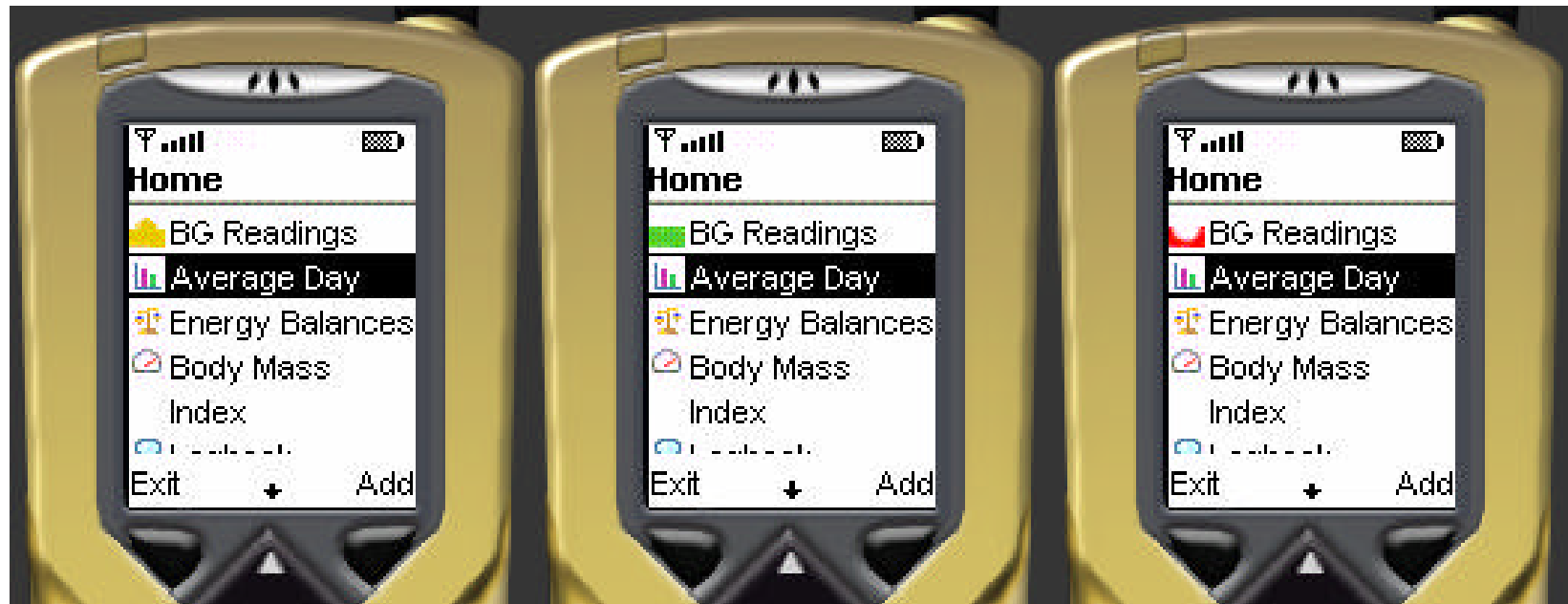
Day Monitoring of Narcoleptics



(Kwok, 2004)

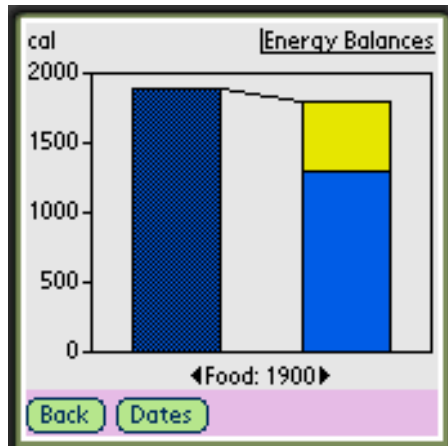
Diabetes Monitoring

EID Design of Interface on mobile device

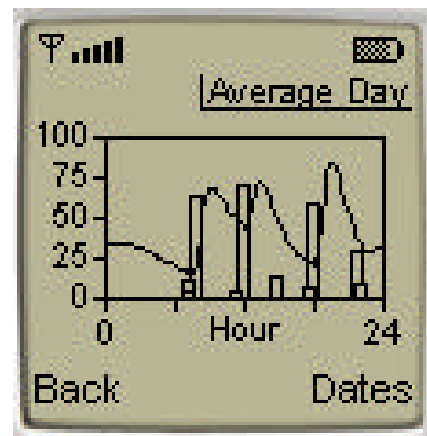
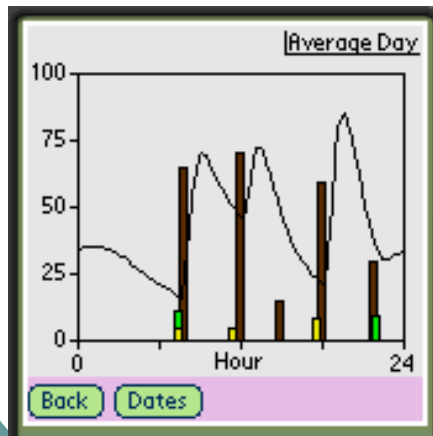


(Burns and Hajdukiewicz, 2004)

Diabetes Monitoring Functions



Energy balances
(Color Palm on left,
Motorola i85 phone on right)



Average daily carbohydrate
intake (bars) and plasma
insulin levels (curve)

Conclusions

- Effective ecological interface design addresses the needs of the user while maximizing available information
- The use of ecological interface design in e-Health can increase the effectiveness of the system and reduce human error

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